

HORTICULTURAL ABSTRACTS.

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INDEX OF CONTENTS.

HORTICULTURE—MISCELLANEOUS	Nos. 150-153
TREE FRUITS, DECIDUOUS	154-198
Fruitgrowing in general	154-158
Breeding	159-164
Propagation	165-167
Rootstocks	168-174
Root growth	175-177
Growth, Nutrition	178-183
Pollination	184-186
Manuring and cultural practice	187-198
SMALL FRUITS, VINES, NUTS	199-213
PLANT PROTECTION OF DECIDUOUS FRUITS	214-233
VEGETABLE GROWING	234-247
FLOWER GROWING	248-249
CITRUS AND SUB-TROPICALS	250-266
TROPICAL CROPS	267-287
STORAGE	288-296
PROCESSING AND FRUIT PRODUCTS	297-302
NOTES ON BOOKS AND REPORTS	303-313

Horticultural Abstracts

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HORTICULTURE—MISCELLANEOUS.

150. KALSHOVEN, L. G. E. 674.048.4
Een nieuw middel voor houtconserveering : het xylamon. (**Xylamon—a new specific for preserving wood from insect attacks.**)
De Bergcultures, 1933, 7 : 1006-8.

A report on xylamon, a German preparation of chlorinated hydrocarbons, which is stated to be so efficacious in the destruction or prevention of all wood boring insects and wood destroying fungi including dry rot that its use "will bring about a complete revolution in the extensive and many sided work of the protection of wood". This article first recounts the successes claimed for the preparation in Europe in combating well established death watch beetle and dry rot, e.g. in the roof timber of the cathedral at Bonn, and then proceeds to describe its effects on pests in the tropics, a problem which had not previously been investigated. It was found completely successful with both deep and surface borers and, more important still, with the destructive termite *Cryptotermes domesticus* whose hidden activities, generally directed against furniture and house timber, often remain unsuspected until the collapse of the article attacked. The preparation can be applied by painting, spraying, or dipping, it is harmless to man or animals, and its preservative effects are permanent. It is insoluble in water and can therefore be used with under-water constructions. It takes paint readily and in a very short time after application. The manufacturers are Consolidierte Alkaliwerke, Westregeln, Magdeburg, Germany. [Full translation available.]

151. MOORE, C. N., AND HASKINS, C. P. 537.531 : 631.52
Physiological variations in certain crop plants following seed exposure to high voltage X-rays.
Bot. Gazette, 1933, 94 : 801-7, bibl. 3.

Initially the authors divided the seed into 2 sets, one being soaked for several hours in distilled water and then superficially dried with filter paper before irradiation. But later, finding that susceptibility was not affected thereby, they abandoned this procedure. Both seed lots were spread as a single layer in containers on a table beneath the Coolidge tube and treated for from 0.5 to 128 minutes. They were then sown immediately in flats or pots in good soil and propagated in a greenhouse. Some were later transferred to outdoor conditions. *Tung oil*. The changes produced with hard X-rays were of the same type as with cotton. Fasciation, change of growth rate, chlorophyll defects and tissue duplication, inversion and replacement with corresponding alteration of leaf form were all seen. *Phlox Drummondii* and *Antirrhinum*. Alterations in growth rate, leaf form, leaf pigmentation and plant habitus were not infrequent

in several hundreds of phlox and snapdragon, but no alteration of flower colour or form attributable to the rays was noticed. *Citrus Aurantium* seeds were given very long exposures to the high voltage rays in an attempt to determine the limit of tolerance for the species. An illustration is given of a case of extreme fasciation without leaf deformation thus caused. Further investigation will be necessary before a report can be made on the aberrations obtained.

152. NEHRU, S. S.

631.588.1

New methods in electro-culture.

J. Roy. Soc. Arts, 1934, 82 : 231-57, bibl. 3.

The lecturer describes how his first successful experiment which consisted of sparking the roots of balsam plants indicated to him that sparking for a short time serves to energize the plant roots, soil or sub-soil and made him decide to explore the whole field of seed and of soil "energetics". Experiments were accordingly started in India on a wider scale with a number of plants including mangoes, gooseberries, strawberries, oranges, various garden flowers, cauliflowers, lettuces, onions, potatoes etc. Results were encouraging. In fruit plants increased growth and earlier ripening were achieved, while treated flower plants also gave finer and more flowers, greater disease resistance and longevity. Considering further methods of seed treatment the author deals shortly with the following types:—A. *Sparking methods*. (1) Simple continuous sparking, (2) sparking and radiation. B. *Radiation methods*. (1) With violet rays, (2) with ultra violet rays, (3) with X-rays. C. *Radio-magnetic methods*, being "peculiar and original methods applicable continuously and successively to seed, soil and plant". He next turns to soil treatment and describes the "tickling" and the radio-magnetic methods. "Tickling" consists essentially in pumping highly charged air rich in ozone, nitrous gases, electric ions, all got by sparking air under pressure, into the soil or subsoil, i.e. the root area of the plant. The radio-magnetic method necessitates covering the soil with wire-netting. In a further section he shows how it is possible to energize plant roots by treatment through jackets or aprons of wire-netting. Finally he describes how buds and flowers can be "energized" with success by stimulating with very feeble currents. He makes recommendations for the practical setting up of the apparatus necessary for all the above and warns against discouragement arising from isolated failure, noting several factors which may be responsible for it. [The author's data though not conclusive are very suggestive of the possible uses of electricity and the advisability of work along many different lines.—Ed.]

153. PITCAIRN, A.

634/635

Cyprus ; an Empire source of food supplies.

Food Manufacture, 1934, 9 : 96-8.

A short account of the fruits and vegetables of Cyprus by the Assistant Director of Agriculture written from the point of view of their suitability or otherwise for food manufacture.

TREE FRUITS, DECIDUOUS.*

Fruitgrowing in general.

154. LACARELLE, M. F.

634.1/8

L'experimentation arboricole au Maroc. (**Arboricultural research in Morocco.**)

Congrès international d'arboriculture fruitière et de pomologie, Morocco, 1934, pp. 43-8.

The director of the newly established fruit research institute in Morocco here outlines its objects and procedure. Seven experiment stations, from 5-20 hectares in area, have been established throughout the country under conditions diverse as possible. To mention but a few items from an ambitious programme, research will be directed to establishing in the country fruits of all kinds not only suitable for the climate but capable as regards quality of competing in the markets

* See also 308, 310, 313.

of the world. It is proposed to begin by acquiring from exterior sources as large a collection as possible of fruit trees of known commercial value besides carefully examining local gardens for likely subjects. The subject of rootstocks will receive careful consideration. Breeding and bud selection will be undertaken. Self-sterile and inter-sterile varieties have to be marked down and pollination experiments initiated. Methods of ensuring that the farmer takes prompt advantage of all improvements are to be devised. The question of processing local soft fruits will be considered. Special attention is to be paid to methods and times of marketing, the particular aim being to avoid coincidence with periods of glut in Europe. The Sherifian Government have allowed a period of six years to bring this programme to a successful conclusion!

155. BAUDIN, M. R. 634.1/7
 Rapport sur l'étalonnage des variétés fruitières de Meknès. (**Registration of fruit trees.**)
Congrès international d'arboriculture fruitière et de pomologie, Morocco, 1934,
 pp. 32-4.

The attempts made by the Fruitgrowers Association of Meknès, Morocco, to register any fruit trees of outstanding merit in the district are described. Large numbers of fruit trees have been imported from time to time. In many cases they proved untrue to name, or changed their characters with the climate, or their names were lost. The aim of the Association is gradually to reduce the multiplicity of varieties, many of them indifferent, and to supplant them with a few sorts only, selected mainly for their acceptability in foreign markets. Those concerned in this attempt to place Morocco in the ranks of the fruit exporting countries are fully alive to the difficulties of competition in times of glut abroad and are proposing to concentrate particularly on those varieties which mature when European fruit is scarce. Their choice is thus restricted at the outset. Scions from selected trees together with proved varieties from abroad will be collected in experimental orchards for mass reproduction and future distribution among the colonists of any that survive the high standard that has been set. Local trees selected for trial are card indexed with a minute description. A duplicate card is given to the owner who is expected to record his future observations thereon, these being checked annually by the Association. Grafts and budwood from the tree remain the property of the owner who, however, in return for the advertisement contracts to supply 15% to the Association if required during the normal grafting season. [Presumably free of charge?—Ed.] The disposal of these grafts is entirely at the discretion of the Association. Owners desiring their trees to be registered must give free access to the trees to the Association's agents for purposes of observation or for the removal of scions. Eight days' notice will be given and the owner must be present when the scions are taken. Nurserymen selling trees propagated from these sources will be required to enter on their invoices the registered number of the tree providing the scion and the name of the rootstock on which the scion is worked. In three years many hundreds of fruit trees have been examined but only 32 have been considered worthy of registration.

156. ROZET, B. 634.1/2
 Etude des espèces et variétés continentales déjà introduites et donnant de bons résultats. (**Continental species and varieties of fruit trees already introduced with successful results into Morocco.**)
Congrès international d'arboriculture fruitière et de pomologie, Morocco, 1934,
 pp. 15-24.

Varieties of apricots, peaches, plums, cherries, apples, pears, quinces mostly introduced into Morocco since 1920 are discussed, and those likely to prove most commercially suitable either as fresh or as manufactured products are named. The first ripe apricots should be ready for export about May 10th, the earliest varieties being Newcastle Early and Bullida, at Marrakesh. The season for late varieties ends in mid-July. The peach season lasts from June 1st to September 10th according to district, but under present conditions the fresh fruit cannot be successfully exported. Plums of European origin (*Prunus domestica*) are successful chiefly in the highlands,

while the asiatic varieties *P. cerasifera*, *P. triflora* and the american *P. americana*, *P. Munsoniana* etc. are proving very adaptable in the maritime zone and the plains. It is almost essential to grow varieties ripening before the sirocco which blows from 12th to 25th of July, otherwise, the author remarks, the fruit is simply cooked on the tree. Cherries are confined at present to a few localities in high altitudes but their range could probably be extended to somewhat warmer regions. The season is from April 25th (Bigarreau Précoce de Boppart) to June 15th (Belle Magnifique). Apples and pears are a doubtful crop. Ninety-seven varieties of apples and 80 varieties of pears are under trial, but none show commercial possibilities except for purely local markets. Almonds are universally grown even close to the sea. Their possible industrial value is to be investigated.

157. VIVARELLI, L., AND ALVISI, S. 634.38

Il " *Morus nigra* " e il " *Morus alba* ". Indagini storiche. (An historical note on the mulberry species *M. nigra* and *M. alba*.)

L'Italia Agricola, 1934, 71 : 187-93, bibl. 33.

The authors' investigations show that *M. nigra*, native of Western Asia and the Mediterranean, was cultivated in classical times and up to the Middle Ages in Italy for its fruits and their medicinal properties. Its cultivation increased on the introduction to Greece and Italy of the silk worm industry in the sixth to the ninth century. *M. alba* only arrived in Tuscany in 1434 but its cultivation spread rapidly by reason of its greater nutritive value to the silk worm and it has now practically ousted *M. nigra*.

158. DUCROCQ, G. 634.22

Le prunier Japonais et ses hybrides. (The Japanese plum and its hybrid.)

Congrès international d'arboriculture fruitière et de pomologie, Morocco, 1934, pp. 25-31.

The history of the plum and the origin of a number of hybrids are given. Out of 16 varieties mentioned only one, Climax, is self-fertile. Beauty, Methley and Santa-Rosa are partly self-fertile. A useful table shows the degrees of inter-fertility of 13 varieties, the degrees being classified as good, fair, poor or bad. The best pollen bearers are the late flowering sorts. It is advisable to keep bees in the orchards. Rootstocks are :—Myrobolan which succeeds everywhere with all varieties ; Mariana (*Prunus cerasifera* × *P. Munsoniana*), for light sandy soils, has perfect compatibility with all varieties ; peach, light gravelly well drained soils, compatible with all except Climax ; almond for dry stony and calcareous soils ; it is, however, only fully compatible with Apex Plumcot, Duarte, Formosa ; apricot, though sometimes used, is not recommended unless nothing else is available, the only varieties with which it is reasonably compatible being Kelsey, Satsuma, Wickson. Thinning of the fruit is essential. It should be done after the natural fall of immature fruits. The remainder should be thinned to 7-10 cm. apart. The fruit continues to swell until it is fully coloured and ripe, increasing 2% in size in the last 10 days. Fruit picked after it has once begun to colour will continue to do so and to ripen even in the dark. The sugar content of picked fruit does not increase but the acidity diminishes. Suitable cool storage temperatures are +11° C. to +6° C. At the former temperature the fruit loses its firmness twice as fast as at the latter. The variety most extensively grown in Morocco is Santa Rosa. Algeria has pinned her faith to Burbank, while in Spain Golden Japan is preferred.

Breeding.*

159. CRANE, M. B., AND LAWRENCE, W. J. C. 634.11 : 576.312.32

Genetical studies in cultivated apples.

J. Genetics, 1934, 28 : 265-96, bibl. 37.

The following characters of the apple have been investigated, and an attempt made to analyse their mode of inheritance :—ground colour, anthocyanin colour, flesh colour, fruit surface.

* See also 169.

fruit size, fruit shape, flavour, time of ripening, albinism, root-burr formation. With the exception of albinism, no sharply discontinuous segregation has occurred. It is suggested that the wide and intergrading variation which occurs with respect to most of the characters studied is due to the action of polymeric factors. The probable origin and constitution of the apple are discussed in relation to the genetic data. The results obtained from crosses between diploid and triploid and between triploid and triploid varieties are described. It is shown that although an occasional vigorous seedling may arise from such crosses, the large majority make very poor growth, and this lack of vigour is associated with an aneuploid chromosome constitution. [Authors' summary.]

160. ROSCOE, MURIEL V. 634.11 : 576.312.32
The chromosomal constitution of certain cultivated apple varieties.
J. Genetics, 1934, 28 : 157-67, bibl. 17.

The author's investigations were carried out in Nova Scotia. Of the 18 varieties studied 4 were found to be triploid, namely, Bank's Crimson Gravenstein, Fallawater, Nonpareil (Roxbury Russet), Stark, while the rest were diploid, Crimson Beauty of New Brunswick, Deacon Jones, Delicious, Duchess, Golden Russet, Grimes Golden, Jonathan, Red Spy, Reinette Rouge d'Hiver, Wagner, Wellington, Winter Banana, Wolf River, York Imperial. Certain distinguishing characteristics in the two classes are considered.

161. STRACHAN, C. C. 634.11 : 575.252
Colour strains of the Delicious apple.
Scientific Agriculture, 1934, 14 : 384-99, bibl. 25.

The results of a comparative study over a three year period of four distinct red bud variations of the Delicious apple and the ordinary striped strain from which they originated are discussed. The new red strains coloured earlier and to a greater extent than the striped strain from which they originated. There was no significant variation between red and striped strains in pressure tests, pH, conductivity, tannin and nitrogen determinations, titration curves, respiration and evaporation loss tests, acidity, keeping quality, rate and quantity of sugar development. The early red colouring and high colour was not necessarily associated with a high sugar content. The three flesh colours, green, white, yellow, were found to be reliable guides to maturity. The green fleshed fruits judged by skin colour of ordinary Delicious were nearly all placed in grade C, but in the red strains many of the green fleshed fruits qualified by their red skin colour for Fancy or Extra Fancy. The slightly lower sugar content of red strain Extra Fancy may be due to the inclusion among them of red skinned but green fleshed fruits. [Cf. Palmer, R. C., *H.A.*, 1932, 2 : 1 : 9 and 2 : 4 : 320.—Ed.] Propagation of red and striped strains on a clonal rootstock No. 227 showed some incompatibility of this stock with the red strain, the young growth died during the summer and the rootstocks themselves were killed, possibly from some toxic substance transferred from the bud to the rootstock. Even the suckers sent up by the rootstocks failed to keep them alive.

162. SANSOME, F. W., AND ZILVA, S. S. 634.11 : 577.16
Polyploidy and vitamin C.
Biochemical J., 1933, 27 : 1935-41, bibl. 11.

The work described here arose out of previous investigations by Bracewell, Crane and Zilva on the antiscorbutic potency of apples [see *H.A.*, 1931, 1 : 4 : 413, and 1933, 3 : 2 : 263]. Crane and Zilva considered that despite certain anomalies in the evidence produced so far, it did favour the theory that a higher vitamin C content is associated with a higher number of chromosomes in the somatic tissue of the apple. Conclusive evidence could only be obtained by comparing the polyloid and the diploid form from which the former was derived. This comparison being far from convenient in the apple it was decided to use as a starting point the tomato, a fruit in which polyploidy can be easily induced. They summarize their results as follows:—"The tetraploid and diploid forms of the strains of the tomato, DOPR, dopR, dopr, DOPr, obtained by the induction of polyloid method and subsequent vegetative propagation were examined

for their vitamin C content by the prophylactic test. All the tetraploid strains were found to be about twice as active as the diploids. The tetraploids contained rather more than 1,000 International Units or 50 mg. of ascorbic acid per 100 cc. of juice. The above results strengthen the evidence obtained by Crane and Zilva that in the case of apples there is a connection between the vitamin C content and the number of chromosomes. There is no association between the genetic factors DR, dR, Dr and dr and the vitamin C content of the tomato." Yet as regards the apple, one of the diploids, i.e. Lane's Prince Albert, was as active as the moderately active triploid apples. The authors wonder whether it is possible that the very active triploid apples were derived from a diploid strain or strains of equally high antiscorbutic activity? Again can the triploid Gravenstein with its low antiscorbutic activity be derived from a diploid form having this character?

163. DARLINGTON, C. D. 634.22 : 576.312.32
Studies in Prunus, IV.

J. Genetics, 1934, 28 : 327-8, bibl. 4.

The sweet cherries (*Prunus Avium*) which were previously reported to have extra chromosomes are found from root tips to be diploid ($2x=16$). They cannot therefore be derived directly from hybridization with sour cherries as hitherto believed. [Author's summary.]

164. RUDLOFF, C. F. 634.22-1.523
Prunus cerasifera Sämlinge aus Anatolien und ihr Wert für die Pflaumen-
 züchtung. (***P. cerasifera* seedlings from Anatolia and their value to plum
 breeding.**)
Obst. u. Gemüsebau, 1934, 80 : 21-2.

An account of the behaviour of some 39 seedlings raised from seed collected by Baur in his travels through Asia Minor and sown in 1927. The resulting seedlings are a decided mixture, showing every colour of leaf, shape of plum, and time of ripening. The flavour of the plums is not of the first rank and the flesh is rather apt to stick to the stone. They have, however, in these few years shown certain characters which, it is thought, may make them of great use in breeding. Thus, they grew extremely vigorously, 1.5 metres being unexceptional for one year's growth. Although growing in a definite frost trap, where in the winter of 1928-29 scarcely one of the cultivated varieties escaped injury, the Anatolians were quite unaffected. Again they came through the dry summer of 1929 with flying colours and without showing the slightest decline in vigour. In the autumn of that year they were transplanted to an equally sandy soil without any special watering and suffered not a whit. Now in the fifth year they are about 5 metres high and the same in spread. They have been purposely neglected in the matter of cultivation and have received no manure, despite which they cropped very heavily last year, averaging some 50 kg. per tree. Harvesting is easily effected by shaking, and the boughs are so elastic as to bear large crops without breaking. They were artificially crossed for the first time in 1933 and results are awaited with great interest.

*Propagation.**

165. GARNER, R. J. 634.1/2-1.541.44
A method of converting unprofitable fruit trees.
East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 103-8, bibl. 6.

The operations described here have already been successfully used in Tasmania by P. H. Thomas (*Tasmanian J. Agr.*, 1930, 1 : 198-202, *H.A.*, 1931, 1 : 2 : 152, and *Dept. of Agr. Tasmania bull.* 3). Their adaptation to conditions in south-eastern England is here detailed. The system is known as "porcupine grafting" and consists essentially in preserving the framework of the tree and in

* See also 249.

placing scions on every branch where it is thought desirable to have fruiting spurs or lateral branches, instead of beheading the 4 or 5 main branches close to their junction with the main stem and inserting a few grafts in the stumps. The normal whip-and-tongue graft is used and the graft is tied and waxed. Where the framework is found devoid of laterals grafts are inserted actually into the main branches. Two alternative methods are described, but in view of the time necessarily devoted to tying with raffia, loosening and retying until the graft is established, the author has evolved a new method which he here describes under the title of "stub grafting". In this case the scion is prepared with its basal end in the form of a wedge with one slanting cut about $\frac{1}{2}$ inch and the other about 1 inch long. The lateral branch then receives a cut which begins $\frac{1}{4}$ inch from the main branch and extends down to the base and almost to the centre of the lateral shoot. Bending the lateral opens the cut and enables the scion to be inserted, after which the shoot is released and cut off just above this point. No tying is necessary when the operation is successfully performed. Waxing is done as usual. The practice of nailing on to avoid the expense involved in tying and retying is also noted. Under Tasmanian conditions "porcupined" trees have borne from 5 to 12 cases per tree 18 months after grafting. Further trial, however, is necessary in England before it can be decided whether the heavy initial expense is justified by quick returns.

166. METLITZKY, S. A., AND OTHERS. 634.11-1.541
Apple yearlings culture without stubs. [Russian-English summary.]
Transactions of the Research Institute of the North Fruits Farming, I. W. Michurin,
 1934, 1: 1-33. (Name of journal as printed.—ED.)

The methods described here would appear to be the same as those described by Lange in 1930 (*H.A.*, 1931, 1: 1: 34). In both cases the advantages are discussed of dispensing with the stub which some orchardists leave above the bud union when cutting back the stock on young budded trees. The stub is used as a support to the growing bud. The author estimates that the use of this stub entails an additional expense of 35% of the total labour costs of the second year and that the benefits to be derived are negligible. If support for the growing bud is needed, which is seldom, it can be provided by a metal clip which fastens below the bud and by means of a concave tongue projecting upwards and partly enfolding the bud guides it into an upright growth. [A clip of this nature is described and illustrated in *Landwirtschaftliche Jahrbücher*, 1933, Band 77, Heft 3, pp. 345-66.—ED.]

167. SASS, J. E. 634.11-1.541: 581.144
Formation of callus knots on apple grafts as related to the histology of the graft union.
Bot. Gazette, 1933, 94: 364-80, bibl. 13.

The data presented were obtained from observations of piece-root tongue grafts accurately and cleanly made from scion wood of Wealthy apple trees on 1-year-old Kansas grown French crab seedlings. All the stages of callusing including cambial bridging and subsequent healing were examined and are described, while particular attention was paid to the formation of callus knots on the lip of the scion where it joins the stock. Callus was found to be produced exclusively by tissues outside the xylem cylinder. Where grafts are well matched, an arc of cambium, continuous with the respective cambia of stock and scion, is differentiated from cells of the intervening callus. The complete cambial layer sheathing the union subsequently lays down a vascular cylinder, which comprises the second annual ring of the tree. The size and vigour of the tree at the end of the first growing season are conditioned by the degree of effective continuity in the new vascular sheath formed round the union. The callus knots referred to above develop on the scion lip as the result of obstructed union between scion lip and stock. Histological interpretations are suggested for the presence of large lip knots on good trees and the absence of pronounced knots on poor trees. It is noted that the internal differentiation of masses of non-pathogenic excess callus somewhat resembles the histology of crown gall as described elsewhere.

Rootstocks.

168. CHRISTIEN, —. 634.1/5-1.541.11
 Etude des sujets porte-greffes à adopter au Maroc. (**Rootstocks in Morocco.**)
Congrès international d'arboriculture fruitière et de pomologie, Morocco, 1934,
 pp. 35-9.

Citrus. The most suitable rootstock is the sour orange. Other varieties, in particular a local citron called M'guer-Gueb, give better growth and are often used but are much subject to gummosis from which the sour orange is comparatively free. *Olives*. Can be grown from cuttings and left on their own roots in normal soils. On shallow ground, however, the table varieties especially lack vigour and are better grafted on some hardier sort. A general utility stock for any soil is Berri which is described as being midway between the wild olive and the cultivated forms. On really poor lands, or lands at high altitudes the wild olive is suggested. *Apricot*. The almond should be used on dry or chalky soils, peach on alluvial soils, myrobolan on clay and damp soils, but for the average soil of no strongly marked characteristic the mish-mish or native apricot is recommended. It has perfect compatibility with all varieties and produces much stronger trees than the other stocks. *Almond*. The native varieties both sweet and bitter are suitable stocks for cultivated sorts. The assertion that bitter almond stock imparts some of its bitter flavour to its scion whether almond or other fruit is refuted. *Loquats* are grafted on seedling stock and on quince. Grafting on hawthorn (*Crataegus* sp.) seems to hasten production but is not much used. *Walnuts* are rarely grafted at present, the existing plantations being of seedling origin. The native race would be recommended as a stock for the French varieties but for its susceptibility to *Armillaria mellea*. The more resistant *Juglans nigra* of America is undergoing trials as a rootstock. *Peach*. The almond is used on dry and rocky ground. It is recommended for early varieties anywhere, as it has been proved to advance maturity by at least five days over peach stock. Myrobolan is used on damp and clay soils. It outgrows the scion, however, and forms large swellings at the point of union. [In England many forms of clonal and seedling myrobolans are found incompatible with peach.—ED.] *Pear*. The native quince raised from cuttings is a useful stock, but the root system develops poorly on heavy land. Seedling quince is free from this trouble. Quince grafted trees are shorter lived, but earlier in coming into bearing. Their dwarfing effect is an advantage in a country where pears on pear stock quickly produce trees too large for adequate disease control. Hawthorn, which is found wild everywhere, resembles quince in its stock effects. *Plums*. The following stocks are used for plums. Seedling myrobolan for all soils. Mariana from cuttings for sandy soils. St. Julien and the native plum give vigour but sucker very freely. Native peach and apricot in well drained soils are excellent for Japanese plums. The union is perfect and there is no overgrowth of stock as when the myrobolan is used for this fruit. Almond is used in dry, stony, or calcareous sods. *Prunus Davidiana* is under trial and is reputed to be resistant on salt land.

169. TYDEMAN, H. M. 634.11-1.541.11
The testing of new varieties of apple rootstock. A progress report.
East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 94-9, bibl. 2.

The crosses made in the breeding work which is in progress at the East Malling Station in conjunction with the John Innes Institution have two objects. First the establishment of a race of rootstocks which will combine the other qualities of a good stock with that of immunity to woolly aphis. Here the work has chiefly consisted of crossing Northern Spy and the Malling series of Paradise stocks. In the second place crosses have been made merely between rootstocks of known good performance in the hope of combining their qualities. This short report summarizes and discusses attempts to effect an initial sorting out of the resulting seedlings in the nursery by grading for precocity and vigour during the first three years.

170. KNIGHT, R. C. 634.11-1.541.11

Further observations on the parts played by root and stem in stock influence.

East Malling Res. Sta. Ann. Rept. for 1933, A. 17, 1934, pp. 114-6, bibl. 4.

Records of trees up to 6 years old have confirmed the conclusion indicated by 3 years' records that the root system is more important than the stock stem in determining scion performance. [Author's summary.] The work was done on apples.

171. TYDEMAN, H. M. 634.22-1.541.11

New varieties of rootstocks for plums. A preliminary report on trials with seedlings of *Prunus divaricata*.

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 100-102, bibl. 3.

Many of the varieties of the plum rootstocks under trial at East Malling, namely:—*Prunus domestica*, *P. insititia*, *P. cerasifera* and *P. spinosa*, having shown marked incompatibility with Czar, seedlings of *P. divaricata* have been worked with this variety. The "take" of buds and the wood growth of the year-old trees are here discussed.

172. ING, E. G. 634.22-1.541.11

Plum rootstocks—a note on some root systems.

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 108-10.

A comparison of the root systems of various plum rootstocks unworked and described by Hatton in 1921 (*J. Pom.*, Vol. 2, No. 4) with the same systems after being worked with various scions and grown thus for 11 years, being finally grubbed in December, 1932. The vegetatively raised root systems have in the main retained their respective qualitative characteristics whatever scion variety they had been worked with. The myrobolan and St. Julien rootstocks of seedling origin showed much more variation even when worked with a single scion variety. Photographs are given of the roots of six different rootstocks.

173. KARMANN, W. 634.23-1.541.11

Steinweischel: *Prunus Mahaleb* als Unterlage für Süszkirschen. (**Mahaleb rootstocks for sweet cherries.**)

Obst. u. Gemüsebau, 1934, 80 : 36-8.

This is a plea for the use of selected mahalebs as stocks for sweet cherries in preference to wild cherry rootstocks. The writer instances cases where replanting on previous sweet cherry land has failed on wild cherry stock and succeeded when mahaleb stocks were used. He notes the fact that the term mahaleb embraces many forms but he does not definitely suggest the necessity for vegetative reproduction of such stocks. He considers that mahalebs can be worked low or high as desired. In a note following this account on a previous article, a correspondent points out that all fruitgrowers are aware of the value of mahaleb as a stock for sweet cherries, but not all are aware that mahaleb does not tolerate transplanting when old. He suggests that disappointment can be avoided by planting one year grafts and forming the desired tree or bush from this.

174. TANAKA, Y. 634.451-1.541.11

Experiments on the rootstocks for the kaki or Japanese persimmon. [Japanese-English summary.]

Imperial Hort. Exp. Sta. Okitsu, Japan, research bull. 14, 1930, pp. 30, bibl. 9.

In Japan two rootstocks only are used for the horticultural varieties of Japanese persimmon, *Diospyros Kaki* L., these being *D. Kaki* L. and *D. Lotus* L. Trials were carried out to ascertain the comparative merits of the two. Seedling stocks of Yamagaki, a *D. Kaki* variety, and *D. Lotus* were grafted with eleven varieties of *D. Kaki*. The following differences were observed. *Lotus* stocks were more vigorous above ground but less so in the roots, were less resistant to drought and wet, and more susceptible to crown gall. *Lotus* were not congenial to all varieties of persimmon while *Kaki* were invariably so. It was observed that *Lotus* always proved compatible with the *Kaki* scions of the hardy varieties from the cold districts but uncertainly so with the

less hardy sorts. As a stock *Lotus* seems to impart hardness to the scion and is always used in preference to *Kaki* in cold districts. The preference of sweet or astringent varieties for either stock was not established. *Kaki* on *Lotus* showed earlier leaf budding and leaf fall than on *Kaki*.

Root growth.

175. ROGERS, W. S. 634.11 : 581.144.2
Root studies IV. A method of observing root growth in the field, illustrated by observations in an irrigated apple orchard in British Columbia.
East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 86-91.

The author describes in detail the technique used by him in constructing observation trenches fitted with glass windows from which apple tree roots may be observed in process of growth. Soil temperature records were taken by thermometers inserted through holes in the trench wall beside the observation window. He notes that in his experiments at East Malling a double recording thermograph records the temperature at 1 ft. and at 3 ft. Soil moisture was also determined and a description is given of "dryness meters", which record the "capillary pull" of the soil which increases as the soil gets drier. Root growth, soil temperature and moisture were found to be closely correlated. It was found possible to note the time, position and amount of root growth, as also the suberization of the root and the formation of laterals. Photomicrographs show these processes. Further observations are being made in similar trenches at East Malling, where records have now been taken for 3 seasons.

176. VYVYAN, M. C. 634.11-1.541.11 : 581.144
The distribution of growth between roots, stems and leaves in a young apple tree and its possible bearing on the problem of stock effect on tree vigour.
East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 122-31, bibl. 11.

The material used was 1,000 carefully selected rooted shoots from the stool beds of Malling No. XIII, a vigorous stock. These were defeathered and cut back to a uniform length. The roots were also cut back uniformly. Fifty were used as an initial sample to determine dry weights of stems and roots at time of planting. The rest were planted out. At intervals during the next two years samples of 50 or 25 were lifted as intact as possible and records were taken of growth of stem, roots and leaves. The total annual increment was found to be distributed in approximately constant proportions between roots, stems and leaves irrespective of size and age of tree. This in the author's opinion explains how the constant stem/root ratio found in trees of a given scion-stock combination on a given soil is attained and maintained. Further, he points out that a constant stem/root ratio means that stem and root are both growing at the same rate, e.g. must take the same time say to double in weight. In the case of a vigorous scion and a slow growing stock growing as one tree their rates of growth must be adjusted to a common value, each affecting the rate of growth of the other.

177. KNIGHT, R. C., AND HOBLYN, T. N. 634.11 : 581.084.2 : 588.144
The effect of size of tree on the relations between various records of roots and stems of apples.
East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 117-21, bibl. 11.

Many and varied have been the records taken and detailed of different phases of tree growth. They have included length of new stems, girth of main stem, height and spread of branches. Each gives a measure of some character of the tree, but so far it has been impossible to get a clear idea of the mutual relationships of these different measurements or how far any is representative of total tree weight. The root system has obviously been the source of great difficulty. The authors summarize as follows:—Measurements were taken of stems and roots of nearly 400 2-year-old Grenadier trees on stock VI. Confirmation was obtained of previous indications that "percentage fibre" [both when taken as roots under 3 mm. diameter and as roots under

1 mm.—ED.] decreases with increasing weight of root system. Proportion of stem is constant throughout a wide range of size of tree. The ratio of weight of scion to cross sectional area of main stem increases with the weight of the tree.

Growth, Nutrition.

178. HEINICKE, A. J., AND HOFFMAN, M. B. 634.11 : 581.13 : 581.144.4
The rate of photosynthesis of apple leaves under natural conditions. Part I.
Cornell Agr. Exp. Sta. Ithaca, bull. 577, 1933, pp. 32, bibl. 46.

The purpose of the authors is primarily to investigate the ecology rather than the dynamics or chemistry of photosynthesis. Their chief concern has been initially to determine the average rate of assimilation over a period of several hours and the extent of fluctuation in the activity of a given leaf from day to day. In this paper special attention is given to a description of the procedure, the reliability of the methods used and the factors influencing results. Leaves of one-year-old McIntosh trees were used in the investigations, the photosynthetic activity being estimated by determining the differences in CO_2 content between a continuous stream of normal air and a similar stream of air passed over leaf tissue confined in a special assimilation chamber. The field equipment is described in detail. Two types of assimilation chambers were used, namely the cellophane or plastacele envelope, in which the entire leaf is enclosed, and the cup chamber which is fixed to the underside of the leaf. Notes are made on the following:—standard procedure, the stock solutions and their care, filling the reservoir tanks, attaching the assimilating chambers to the leaves and the reservoir tanks to the apparatus, regulation of the air supply, calibration of the flow meters, meteorological and plant condition records, the time necessary for determinations, titration and calculation of results. The authors then proceed to consider the dependability of their results. They deal with the question of air supply and what can be considered normal in this respect. The importance of the individuality of the leaf and its effect on their results is discussed and the relation between leaf colour and photosynthetic activity is considered. The results, moreover, of photosynthetic activity on 3 particular leaves at 3 different seasons of the year were observed and are here tabulated. On the whole the rate of apparent photosynthesis of apple leaves found during these investigations was higher than the average reported by other investigators working with temperate zone plants. It was evident from data obtained that the internal conditions of the leaf and tree have a profound influence on the efficiency of the foliage for photosynthesis under natural meteorological conditions. All treatments which affect nutrition will affect this. The influence of meteorological conditions on leaf activity was also strikingly exhibited. Any list made in order of importance of the factors that prevent maximum daily assimilation of the CO_2 of the atmosphere under normal cultural conditions would vary with locality and season. The first report is of an introductory character and should pave the way for further reports of work based on the methods described here.

179. CALDWELL, J. S. 634.1/7-1.547 : 581.192
Hydron concentration changes in relation to growth and ripening in fruits.
U.S. Dept. Agr. tech. bull. 403, 1934, pp. 53, bibl. 37.

The writer discusses the work of other investigators in this field before dealing in some detail with the experiments conducted by the Bureau of Plant Industry since 1927 on the following fruits:—apples, citrus, cherries, strawberries, blackberries, dewberries, raspberries, elderberries, pokeberries (*Phytolacca americana*), tomatoes. These were purposely chosen to include a wide diversity of types with respect to development, botanical relationships and structure of fruit, so that any generalizations deduced from them might reasonably be assumed to apply broadly to the fleshy fruits as a whole. From the above experiments it is evident that the young fruits at setting and shortly afterwards have a hydron concentration rather close to the general level found in the vegetative parts and rest of the fruiting structures. They show then a low acidity and a high solids content. The next stage is a short one in which the active acidity content of the young fruit rises very rapidly, e.g. less than 10 fold in strawberries to more than 80 fold in citrus. During this stage water is absorbed very rapidly and a condition of maximum hydration is

attained about the same time as maximum acidity. Weight also goes up quickly at this time. The point at which active acidity and water content cease to rise coincides in time with the marked flattening of the curve of percentage increase in weight. From this point onwards there is little or no increase in the protoplasmic colloids and the formation of primary cell walls ceases. Later development is accompanied by a progressive decline in water content closely paralleling a decline in active acidity, which continues to picking maturity. The author suggests as a working hypothesis, which may need subsequent modification, that variations in the water absorption by the hydrophilic colloids of the young fruit caused by changes in hydron concentration of the tissue fluids may be a factor of prime importance in determining the form and slope of the growth curve of the fruit.

180. BENNETT, J. P., AND OSERKOWSKY, J. 634.13 : 581.192

Copper and iron in the tracheal sap of deciduous trees.

Amer. J. Bot., 1933, 20 : 632-7, bibl. 9.

Tracheal sap was obtained by the gas displacement method. Iron and copper were determined calorimetrically, iron by the thiocyanate method, copper by the method of Elvehjem and Lindow. The total electrolyte content of the sap was obtained by determining its electrical conductance. Single Bartlett trees growing in a clay loam, slightly acid soil were dug at about monthly intervals. The branches were segregated in age groups and the tracheal sap was extracted from each group separately. Figures are also given for the copper and iron content of the tracheal sap of other fruit trees namely peach, apricot, almond, quince, prune and cherry examined in the spring. The trend of changes in the iron, copper and total electrolyte content of the tracheal sap from branches of pear trees was found to be:—a rapid rise in concentration in early spring from a lower winter level, a rapid fall in late spring to a summer level near that of winter, a continuance of this low level into winter with or without secondary autumn rise and fall. The parallelism shown in the curves indicates that the copper, iron and total electrolyte concentration are controlled by the same factors. The tracheal sap from branches or roots of all the trees examined nearly always contained more copper than iron.

181. PHILP, G. L. 634.23-1.547.4/5

Abnormality in sweet cherry blossoms and fruit.

Bot. Gazette, 1933, 94 : 815-20, bibl. 2.

The occurrence of numerous abnormal blossoms in the Bing and Napoleon varieties of *Prunus Avium* led to investigations of the extent of this phenomenon. It was found that in the hot interior valleys of the Sacramento and San Joaquin the occurrence was extensive, much less so in the foot hills to the east and west, while it was not seen at all in the coastal valleys where lower summer temperatures are the rule. Nearly all the abnormal flowers contained double pistils, and these on development produced double or malformed fruits. Counts were made and are here tabulated of fruit development from abnormal blossoms on Bing, Napoleon and Montmorency (*P. Cerasus*) trees at the University farm, Davis. Comparison with previous records shows that the percentage of double and malformed fruits varies much from year to year and indicates that they occur more frequently in the years following particularly hot summers.

182. GRUBB, N. H., AND KNIGHT, R. C. 634.23-1.542

The influence of branch pruning of cherries on the growth of suckers.

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 92-3.

The bulk of the Morello trees (about 80 in all) subjected to trial were worked on vegetatively raised Mazzard stocks, a few on Mahaleb, and a few on two varieties of acid cherry. The age of the trees was 9 and 10 years. It was found that very severe branch pruning ("dehorning") was followed by an increase of approximately 100% in sucker growth. The authors suggest that the explanation lies in the fact that the nutrient materials available both from storage and from root absorption are restricted in the pruned tree to a reduced number of developing shoots and a smaller cambial area than in the unpruned tree. A natural result is greater extension

growth, and, when the number of growing points is reduced very considerably as in the case of these cherries, it is natural that the stem growing points represented by the potential suckers should receive a greater proportion of the facilities for growth.

183. REED, H. S. 634.21-1.542-1.547
Correlations between severity of pruning and subsequent growth and fruit yield of apricot trees.

J. Agr. Res., 1934, 48 : 1-30, bibl. 7.

Experiments with different types and different amounts of pruning are described in detail and the results are statistically analysed. The orchard consisted of 56 plots in 4 replications of 14 plots each, each plot containing 5 trees. The following notes are from the author's summary. The amount of wood removed was found to be positively correlated with the growth of the tree in the following season, but this correlation disappeared when partial correlations involving the size of the tree were made. There is indication that trunk growth was somewhat reduced by the heavier types of pruning. The highest yields over a 10 year period were obtained on plots whose trees were moderately pruned in winter to a vase shape. The more severe types of pruning tended to produce fruit of larger size as the trees grew older, provided there was no marked change in environment. No strong correlation was indicated as existing between size of fruit and volume of crop. There was a significant and positive correlation between the yield one year and the growth of the tree in the previous year. Trees pruned in summer and winter showed practically the same correlations as those pruned only in the winter. The author suggests that the setting of fruit evidently depends on the reproductive and vegetative functions of the apricot trees, while the size of fruit probably depends on much the same factors as do wood and leaf growth. An examination of the coefficients of interannual correlations of yields on an unpruned, a slightly pruned and a severely pruned plot indicate that the annual crop of a tree depends on factors other than the amount of fruit produced the previous year.

*Pollination.**

184. BAIBUZ, V. P., AND SERGEEVA, A. 634.1/2 : 581.162.3
The importance of proper cross-pollination as affecting the productivity of fruit crops. [In Russian.]†

Publ. Crimean Zonal Exp. Sta. for Tree and Small Fruit Culture, 1933, pp. 12.

This is a simple plea for a rational lay out of orchards on the collective farms based on (1) the age at which the particular fruit trees first yield fruit. [Varieties of apple bearing first in their eighth or ninth year are here considered to be "early bearing".—ED.], and (2) the necessity for cross pollination in the case of most tree fruits. Lists are given of varieties of apples, pears, plums and cherries which should under Crimean conditions be planted together. These include many varieties well known in Western Europe.

185. VON VEH, R. 634.1/2 : 581.162.3
 Beiträge zur Frage nach den Befruchtungsverhältnissen der für Deutschland wertvollsten Kern-, Stein- und Beerenobstsorten. II. Entwicklungs- geschichtliche cytologische Untersuchung der Samenanlagen der Apfelsorte "Schöner v. Boskoop". (On the conditions governing fruit formation in the most important stone, pome and bush fruits in Germany. A growth and cytological investigation of the ovule of the Belle de Boskoop apple.)
Gartenbauwissenschaft, 1933, 8 : 146-214, bibl. 27.

The writer concludes from his experiments that pollen is so ample in the free blooming Belle de Boskoop that there can be no question of failure due to lack of pollination. Since plenty of fertilized ovules containing healthy embryos were found, failure to develop fruits could

* See also 181.

† Abridged translation with lists of cross pollinators available.

only be attributed to constitutional and physiological growth factors in the mother plant. He considers that, while results of pollination experiments in different countries make a valuable contribution to a solution of the problem, negative results in such experiments cannot at once be considered as proving the absence of pollination, since failure to set fruit is not proof of failure to effect pollination. Further investigations are necessary to determine the influence on setting of the position of the inflorescence on the tree and of the blossom in the inflorescence, of the mutual effects of inflorescence and blossom and of the rootstock upon which the tree is worked. The writer obtained the following results, among others, from his cytological studies. The development of the female archesporium of the normal spring flower of Belle de Boskoop was the same as that of the autumn flower. The reduction division of the megaspore mother cell occurred in 1931 4 to 5 days before flowering. In the open blossoms 8 nuclear embryosacs were generally found and only as an exception 2-4 nuclear embryosacs. The pollen tube usually grew through the micropyle into the cap of the nucellus epidermis. Occasionally two pollen tubes could be observed in the epidermis cap and also in the embryosac. The two sperm nuclei were usually to be found near the foremost growing bud of the pollen tube, and within this they pushed their way through the nucellus cap into the embryosac. Vegetative fertilization was observed in a tree of Belle de Boskoop which had been emasculated and pollinated by Landsberger Reinette. Both secondary pole nuclei remained unmerged in one of the sperm nuclei up till the time of union. The sperm nucleus was usually no smaller than the two pole nuclei. After complete fertilization the oospore remained at first unfertilized. During the fertilization of the ovum the endosperm was already 5-6 nuclear. The sperm nucleus, during its passage into the oospore, left in the plasma a clearly recognizable mark or channel which was apparent for a long time. The oospore nucleus and sperm nucleus could not be differentiated by size or shape, but the fertilized ovum nucleus was definitely larger. No appearance of degeneration could be observed either among the fertilized or unfertilized oospores. The unfertilized ovules usually withered up, but it was possible to find developed unfertilized ovules equal in size and as well differentiated as fertilized ovules in the same flower. Usually, however, the fertilized ovules received an impulse to further development which was manifested in an increased size and differentiation of tissue. The ovules of the autumn flowers showed some withering in the nucellus not observable in the spring flowers. The author considers that this may have been due to abnormal nutritional conditions. [The work of Darlington and Moffett has shown that Belle de Boskoop is a triploid.—ED.] A comparison of flowers which died off and those which developed into fruits showed that failure to set was not due to defective pollination but seemed to be largely dependent on special chromosome conditions. The author considers that comparative investigations are necessary into the whole relationship between *Pyrus* and *Malus* varieties, since there is a possibility that the facts revealed by his studies of Belle de Boskoop may be of more general applicability.

H.M.T.

186. MIEDZYRZECKI, CH. 634.1/7 : 581.162.3
 Stérilité du pollen chez les arbres fruitiers. (**Pollen sterility in fruit trees.**)
Congrès international d'arboriculture fruitière et de pomologie, Morocco, 1934,
 pp. 49-56, bibl. 6.
 MIEDZYRZECKI, CH. 634.1 : 581.162.3
 Etudes cytologiques et stérilité du pollen chez le pommier et le poirier.
 (**Cytological investigations and sterility of pollen in apples and pears.**)
Comptes rendus des séances de la société de biologie, 1933, 114 : 1267.

In these two articles the author discusses the various causes of sterility in fruit trees. Faulty morphology of the flowers is responsible in some fruit plants among which may be counted certain American vines, some of the *Prunus domestica* plums with malformed stamens, peaches such as J. H. Hale, Late Crawford and June Elberta, and strawberry varieties which show non-functioning or feeble male organs. The cause may sometimes be found to lie in the make up of the cell and the author cites the work of Kobel and others and his own experiments on apple and pear pollen germination, a full account of which is given in the second article, to show the poor germination of pollen from the triploid varieties. He agrees with other authorities in

urging the advisability when using triploid varieties of interplanting with diploids to ensure fruitfulness. Unfavourable physiological conditions are a third cause of sterility and these may be remedied by suitable cultural operations such as manuring, pruning, ringing etc.

Manuring and cultural practice.

187. STRÖM, R. 634.1/2-1.585
 Fruktträd i gräsvall och öppen jord. (**Fruit trees in grass and in cultivated land.**)
Sveriges Pomologiska Förenings Årsskrift, 1933, 34 : 46-9.

The author produces some rather inconclusive data in an attempt to demonstrate that apples grown in grass land are invariably inferior in yield and quality to apples grown in cultivated land. The grass land trees included in this survey received no cultural attention whatever and were not even sprayed, while those in tilled land were sprayed and otherwise properly looked after. The author estimates the loss from neglect at approximately 5s. per tree, and the loss from grass land effect at 30s. per tree, but does not say how this conclusion was reached. [Full translation available.]

188. KRAUSS, J. 634/635-1.83
 Kaligehalt im Boden, insbesondere in gärtnerischen Kulturboden. Ein Verfahren zur raschen Feststellung von mangelnder u. ausreichender Versorgung mit Kali. (**Potash content in soils especially garden soils. A quick method of determining the lack or adequacy of the potash content.**)
Gartenbauwissenschaft, 1934, 8 : 488-96, bibl. 12.

After noting and discussing Neubauer's method and the light thrown on it by Gehring, Dirks and others the author describes a new method, which in comparison with that of Neubauer and others appears to him to have the following advantages. 1. All soils to be investigated are handled at an even, weak alkali reaction (Phenolphthalein indicator). 2. All the precipitations of potash with ions, such as Fe, Mn and NH_3 which upset sodium cobalt nitrate, are deposited and do not appear in the filtrate. 3. Owing to the perchloride of mercury content the extraction of potash from the soil is very marked. The stock solution is made by dissolving 120g. chemically pure sodium chloride in 1 litre distilled water and then dissolving in this 10g. perchloride of mercury, finally adding to the solution 10g. magnesia usta (calcined magnesia). The stock solution is actually patented by German Patent 558268 of 14.II.1930. The method of carrying out the process is described and is as follows:—40 cc. of the solution are mixed in a beaker with 50g. of airdried soil previously sieved through a 4 q.mm. sieve; the whole is then stirred with a glass rod to an even consistency. The contents of the beaker (150 cc. capacity recommended) are as completely as possible transferred to a filter (diameter 12.5 cm., diameter of funnel 7 cm.) and the filtrate is caught in a 25 cm. measuring cylinder. 5 cc. of the filtrate are then introduced into a reagent glass (16 cm. long, 1.6 cm. outside diameter), 0.2g. sodium cobalt nitrate are added, the opening is closed with a rubber stopper and the contents are shaken for 1-2 minutes. The result is then compared with standards prepared by treating definite known amounts of a solution of 15.38g. KCl. to the litre with the stock solution as above, these standards denoting 0, 7, 14, 25 and 40 mg. K_2O respectively. When the comparison agrees with the 0.7 mg. standard, potassic manuring is certainly desirable under all circumstances, while at the other end of the scale a result agreeing with 25-40 mg. K_2O shows that K manuring is not required.

189. GOSSENBERGER, E. 634.1/2-1.8
 Ist die Verwendung der Düngelanze im Obstbau rentabel? (**Is the use of the fertilizer lance for manuring fruit trees economic?**)
Obst. u. Gemüsebau, 1934, 80 : 9.

These are further notes* on the use of the Heda lance for manuring fruit trees. Operations on a commercial estate are described. The outfit consists of 1 man to drive the sprayer from place

* See H.A., 1933, 3 : 3 : 301.

to place and keep the apparatus working, 2 men each with a lance and 1 man and 1 horse to bring up supplies of fertilizer. Two men are at work, 1 on each side of the sprayer. For a fully grown tree with a spread of 7-8 m. or 24 m. circumference 10 applications, at 1.2 m. apart at the circumference, will be made by each man at each halt, and these will cover half the circumference of the tree. The rest of the circumference is done on returning along the next row. It was found that allowing 12 seconds for making, filling and emerging from the hole, 2 minutes for moving to the next tree, and 5 minutes for refilling the spray tank, 24 trees could be done in an hour. Costings at the rate of 50 pfennigs per man hour, 45 pf. per horse hour, oil fuel hourly expenditure 55 pf., show the cost of the operation per tree exclusive of the cost of the fertilizer, depreciation etc. to have been 12.5 pfennigs, or very roughly about 2d.

190. WALLACE, T. 634.1/8-2.19-1.8

Some physiological disorders of fruit trees. Being paper II at the meeting of the Association of Applied Biologists held in London on December 1st, 1933.
Ann. Appl. Biol., 1934, 21 : 322-33, bibl. 78.

The author deals with the more striking effects resulting from deficiency, excess, or lack of suitability of nutrients and from defective water or meteorological conditions. The following deficiencies are discussed shortly, references being given in the comprehensive bibliography to work on each phase :—(1) nitrogen, (2) potassium, (3) phosphorus, (4) calcium, (5) magnesium, (6) sulphur [not noticed as yet in fruit trees], (7) iron, (8) copper, (9) boron, (10) zinc ; numbers 3, 4, 5, 6, 9, not being as yet reported in the field. Next are considered disorders due to toxic effects of salts and elements. Injury to fruit trees is common where alkali occurs in the soil and where irrigation is practised. Irrigation water containing salts and lack of drainage are common causes of salt accumulation in soils. In citrus the constant application of inorganic fertilizers without the addition of bulky manures has bad effects. In the Wisbech area of England after the abnormally dry year of 1921, a disorder of apple trees, involving scorching and death, occurred and appeared to be due to a high content of salts in the soil. Excess of chlorine due to use of heavy dressings of fertilizers containing large proportions of chlorides often cause injury especially to small fruits. Manganese has been found to be in excess in certain Hawaiian soils and elsewhere and indirectly to cause injury which is directly due to a typical iron-deficiency. Excess boron causes damage to citrus. Disorders primarily due to drought conditions within the fruits, caused by very high air temperatures or prolonged drought conditions occur in apples and pears and are known as cork, drought spot, water core, bitter pit. Certain disorders of vines, the primary cause of which is unknown, are apparently greatly influenced by unfavourable meteorological and soil conditions. Examples mentioned are :—cases of chlorosis, florescence, rougeau, sécheresse. Little leaf of citrus in Palestine is regarded as a form of drought injury. Finally the author discusses briefly two diseases, whose exact cause still remains a mystery but is almost certainly nutritional. They are mottle leaf of citrus and decline disease of the date palm.

191. ROACH, W. A. 634.1/7-2.19-1.811

Injection for the diagnosis and cure of physiological disorders of fruit trees. Being paper III at the meeting of the Association of Applied Biologists held in London on December 1st, 1933.
Ann. Appl. Biol., 1934, 21 : 333-43, bibl. 6.

The author considers that use of water culture and sand culture methods for detecting deficiency diseases, though productive of good results in many cases, is laborious and hardly applicable to large fruit trees. The interpretation of results obtained therefrom is, moreover, complicated by the fact that an increase in the amount of one constituent of the culture solution results not only in its greater absorption by the plant, but also in upsetting the balance of the other elements entering the plant. Applying the experimental substances direct to the soil leads to even greater complications in interpretation, due to base exchange and similar phenomena. Direct injections

of solutions into trees may have decided advantages for studying and even possibly curing physiological disorders, especially those of the "deficiency" type. He notes that the idea is not new, Leonardo da Vinci in the fifteenth century having shown the presence of arsenic in apples by immersing the cut end of a root in a suitable solution! The present author discusses the laws governing the distribution of injected liquids and then proceeds to detail the several methods adopted by him. In working out the general principles he made free use of dye solutions. He describes the technique applicable under the following different circumstances:—1, injection of a whole tree; 2, injection of single branches and their supplying roots; 3, injection of tips of twigs; and 4, injection of branches but not the supplying roots. The differences of effects in summer and winter are noted. As regards results already achieved by such methods the author notes two recent examples of positive results obtained, namely by Andrews, who rendered tea bushes resistant to *Helopeltis* by injecting them with potash compounds, and by Storey and Leach who proved by means of twig injections that tea bushes were suffering from sulphur deficiency. Finally he discusses encouraging results obtained by himself by injection methods. In the first the effect of sodium thiosulphate on apple mildew was shown. In a second experiment marked benefit followed the injection of a large apple tree with potassium nitrate, and in a third experiment growth increase resulted from the injection of small two-year-old apple trees with a mixture of potassium sulphate and ammonium dihydrogen phosphate.

192. ROACH, W. A.

634.1/7-1.811

Tree injection—a progress report.

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 137-41.

Very briefly the author describes 4 methods of making injections, applicable to main branches, current year's shoots, branches intermediate between the above and to the main trunk respectively. He suggests that experiments on these lines may enable manurial deficiencies to be recognized simply and inexpensively. He notes the fact that a certain apple rootstock, the so-called Doucin Amélioré or Malling V is unable to absorb adequate potash from a normal soil and suggests that in similar cases of potash starvation it might well be possible to speed up potash absorption by injection. The work is dealt with at greater length in *Annals of Applied Biology*, 1934, 21 : 333-43, bibl. 6, see previous abstract.

193. HOBLYN, T. N., AND BANE, W. A.

634.11-1.8

Apple manurial trials.

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 59-85, bibl. 12.

The varieties were Worcester Pearmain and Bramley's Seedling 12-year-old trees on known rootstocks. Between 1930 and 1933 these trees, which had been grown under cultivation but unmanured since planting, were subjected to various treatments. In most cases heavy dressings of sulphate of potash resulted in the second season in a remarkable recovery in shoot growth, amount of crop and size and quality of fruit. Nitrogen, in heavy doses of sulphate of ammonia, was generally detrimental, but with potash it further increased growth and cropping. It always reduced fruit colour. Of two other plantations hitherto manured one was grassed down in 1930 and the other was kept cultivated. They were compared for 3 years, nitrogenous manures being withheld from both. Growth fell off markedly in the grass plot and, though in the second year the crop under grass was apparently increased, in the third year it was much smaller than that from the cultivated area. Fruit from the grass plot was very highly coloured. The above results were more marked on the less vigorous rootstocks. A very heavy application of nitro-chalk (15 cwt. per acre) after 3 seasons under grass immediately affected growth but ruined quality of fruit in Worcester Pearmain. A lighter dressing of $\frac{1}{3}$ the above affected shoot growth little, while the quality of fruit was maintained. A light dressing on Bramley's Seedling, one season only under grass, was evident in dark green foliage in autumn and delayed defoliation. A consideration of soils in which these trials took place leads the authors to believe that the applicability of the results obtained is probably not restricted by local conditions, and that the problems studied are similar to those of many growers in Kent and in other districts where conditions of soil and rainfall are similar.

194. LAGASSE, F. S. 634.11-1.84

Nitrogen and the apple tree.

Trans. Peninsula Hort. Soc., 1933, 23 : 5 : 10-16, bibl. 8.

This is based on work at the Delaware agricultural experiment station and on the results of such other American workers as Knowlton, Aldrich, Schrader and Murneek. Murneek's figures indicate that the yearly loss of N to apple trees in full bearing, expressed as nitrate of soda and due to fall of leaves, pruning and fruit removal, would be about 5.25 lb. in addition to the amount necessarily utilized in the seasonal growth of the tree. To keep the trees healthy in is essential that at least this amount should be restored to the tree. Delaware experiments since 1927 on 18-year-old Jonathan apple trees have over this short period demonstrated the following facts. At a dollar a bushel the devitalized trees were profitably rejuvenated by heavy applications of NaNO_3 (10-25 lb.). Trees originally in a vigorous condition maintained their yields very well when the nitrogen was withheld, but began to show signs of N deficiency (yellow foliage, etc.). Greater gains were made after the application of N by trees which had formerly been receiving P or K than by others. Large additional amounts of N applied to trees already in a good state of vigour did not cause them to become over-vegetative and unproductive.

195. TIEDJENS, V. A. 631.84 : 635.64 + 634.11

Factors affecting assimilation of ammonium and nitrate nitrogen, particularly in tomato and apple.

Plant Physiol., 1934, 9 : 31-57, bibl. 40.

The author conducted trials with tomatoes and apples grown in sand cultures at varying pH values and receiving either ammonium sulphate or sodium nitrate. His own results and those of other workers are discussed and it is concluded that the pH value of the nutrient medium has a controlling influence on the assimilation of the ammonium ion. The nitrate ion was assimilated best when absorbed from an acid solution of about pH 4.0, while the pH reaction most favourable for the absorption of the ammonium ion varied with variety between 5.0 and 6.5. The ammonium ion was most quickly available for the synthesis of amino acids, being assimilated immediately, while the nitrate ions had to be first reduced to nitrite and then to ammonium ions by the action of reductase. It hence tended to accumulate under the influence of limited reductase activity due to external or internal conditions. The growth due to the added fertilizer was found to depend on the concentration of the nitrogenous salt in the nutrient solution and the carbohydrates available. Plants containing large amounts of available carbohydrates assimilated ammonium much more rapidly than those not so equipped. In general, ammonium and nitrate salts produced equally good growth provided their limitations were recognized. It is concluded that in the field, given optimum pH conditions in each case, the only advantage one salt would have over the other would arise as a secondary effect due to the particular ion associated with the nitrate or ammonium ion.

196. NIGHTINGALE, G. T. 634.11-1.84

Ammonium and nitrate nutrition of dormant Delicious apple trees at 48° F.

Bot. Gazette, 1934, 95 : 437-52, bibl. 21.

The following notes are from the author's summary :—Dormant 2-year-old nitrogen deficient trees were subjected to a constant temperature of 48° F. and continuous darkness. They were grown in sand, the solutions of each culture undergoing renewal at the rate of 36 litres every 24 hours. Trees were also grown with the same nutrient treatments in water, the water cultures being renewed as above and stirred constantly. The sole source of nitrogen for some of the trees was a complete nutrient solution containing ammonium sulphate supplied at pH 6.0, for others calcium nitrate in complete nutrient solution at pH 4.5. Some cultures were grown without external nitrogen supply but with other essential elements at pH 5.0. The experiment lasted 16 days. The results on roots, bud growth and the accumulation and synthesis of various products are discussed. From these results the author concludes "that there is not directly required a widely different pH value of the nutrient medium for ammonium as compared with that for nitrate assimilation, provided the absorbing surfaces of the roots are not subjected to

extremely acid or alkaline conditions. Practically, however, it would be inadvisable continuously to apply ammonium sulphate to an acid soil, or sodium or calcium nitrate to a very alkaline soil." The acidity of the cells of the different tissues is considered and compared.

197. LARSON, C. A. 634.11-1.8 : 581.192
Effect of fertilizers on irrigated Ephrata fine sand and apple tree response in the Wenatchee orchard district.

J. Amer. Soc. Agron., 1933, 25 : 633-52, bibl. 20.

The object of this work was to discover the effects of various fertilizer treatments on the absorbing complex of the soil and its relation to tree response and yield of Jonathan apple trees. Various methods gauging effect on productivity were tested. Thus water extraction of treated soils did not give reliable indications of relative productivity. Extraction of plot soils with 0.2 N nitric acid did not show the effects of fertilizer applications. Electrodialysis was of no perceptible value in estimating productivity. The amount of nitrate nitrogen contained in plot soils, during the first half of the growing season only, was rather closely correlated with the actual production of fruit. A most interesting discovery was, however, as follows :—Apple leaves from trees on fertilizer plots were analysed once monthly for 5 months for calcium, nitrogen, phosphorus as P_2O_5 , and potassium as K_2O . The variation in percentage of each of these elements over the season reveals a tendency for them to be in a definite ratio to one another when production is good. Plots producing leaves with a relatively low percentage of P_2O_5 and a high percentage of N gave an increased yield. The most favourable ratios for apple leaves are quite similar to those reported by Lagatu and Maume for vines.

198. ALDRICH, W. W. 634.13-1.67
Some response of Anjou pear trees to irrigation.

Oregon State Hort. Soc. 25th Ann. Rept., 1933, pp. 30-35.

Observations were made for 2 years on the growth of pear trees in clay adobe soil at the Medford Experiment Station following irrigation in the summer when little or no rainfall is usually experienced. Neither the actual number of trees tested nor the amount of water given are stated, but the general effects noted during the short period of the experiment are briefly :—Feeder roots, no effect ; leaves, increased efficiency ; fruit growth, slows down in absence of irrigation ; limbs and shoots, increased diameter and shoot growth in same season ; bloom, in 1933 decreased following irrigations in June and July, 1932 ; vigour, increased and shown by growth in following season ; blight and winter injury, apparently unaffected ; fruit keeping quality and flavour, not commercially affected.

SMALL FRUITS, VINES, NUTS.*

199. VASSIE, J. D. 634.711
Raspberry production for the food industries.
Food Manufacture, 1934, 9 : 131-8, bibl. 1.

An economic study of the raspberry industry of Angus and Perthshire. This article deals fully with the development of the industry, the location and size of the holdings, the type of farming on raspberry holdings, cultivation of the crop, marketing and markets, cost of production, effects of the economic depression of 1930-1931 and the case for a raspberry marketing board.

200. UPHOF, J. C. TH. 634.73
De cultuur van *Vaccinium macrocarpon* in de Vereenigde Staten ; een mogelijke industrie voor Nederland. (Cranberry growing in the U.S.A. ; a possible crop for the Netherlands.)

Landbouwkundig Tijdschrift, 1933, 45 : 129-43.

The writer gives a brief description of the cranberry industry in the U.S. (establishing cranberry fields, cultural methods, harvesting, diseases and pests etc.) and he raises the question as to

* See also 309.

whether it might not be a profitable crop in certain parts of Holland, where the acidity of the soil does not allow of the cultivation of other plants. Apparently he is unaware of the fact that it has already been grown for many years on the isle of Terschelling, one of the "Noordzee-eilanden".
V.d.L.

201. DIEREN, J. W. van. 634.73
De ontwikkelingsmogelijkheden van *Vaccinium macrocarpon* in Nederland.
(The possibility of growing cranberries in Holland.)
Landbouwkundig Tijdschrift, 1933, 45 : 697-709.

A review of the history of this crop on the "Noordzee-eilanden", especially on Terschelling. In some parts of these isles the plant grows quite wild. It was found there in 1868, prior to its cultivation in Holland, and its origin is unknown. At present crops are regularly grown in Terschelling and Vlieland. The total surface planted with cranberry is estimated at 200 to 250 acres. The future of the crop is limited in the first place by the lack of suitable soils. Extension is perhaps possible in the east of Terschelling and in certain other places of the northern downs. Essentials are that the industry shall be placed on a scientific basis and that only selected material shall be used initially. Furthermore market sales in Holland will have to be carefully fostered.
V.d.L.

202. MINISTRY OF AGRICULTURE, LONDON. 634.75 : 658.8
Strawberries. Grading and marking.
Marketing leaflet 18, 1934?, pp. 11.

In this leaflet are detailed the general regulations governing the packing and labelling of baskets and punnets of strawberries to be sold under the National Mark.

203. MOOG, H. 634.843
Beiträge zur Ampelographie. V. (A contribution to ampelography.)
Gartenbauwissenschaft, 1934, 8 : 365-84, bibl. 25.

The author continues his series of articles on vines, dealing this time with the differentiation of the numerous *Riparia* varieties growing at Geisenheim and Tiefenbach. Distinguishing features are not usually very obvious. As regards bearing, however, most of the varieties may be classed into one of four groups, which he calls the female pseudo-hermaphrodite group, the male pseudo-hermaphrodite group which occasionally produces berries, the male pseudo-hermaphrodite group which does not produce berries, and the male group proper. Certain distinguishing marks which appear in the earliest stages of foliage growth disappear later—there is little variation in susceptibility to phylloxera. Illustrations are given of the leaves of the different varieties.

204. BARNARD, C., AND THOMAS, J. E. 634.8-1.547.4/5
Fruit bud studies. II. The sultana : differentiation and development of the fruit buds.
J. Council Scientific and Industrial Research, Australia, 1933, 6 : 285-94.

This is the second report on studies carried out at the Commonwealth Research Station, Merbein, Victoria, during five consecutive seasons. (For first report see *Ibidem* 1932, 5 : 47, *H.A.*, 1932, 2 : 2 : 152.) In this article the term anlagen is applied to primordia which have not yet differentiated into (1) inflorescences, (2) transition forms between inflorescence and tendril, (3) tendrils. It is shown that tendril and inflorescence primordia differentiate from morphologically similar anlagen, and that, whereas differentiation into inflorescence primordia takes place during late spring, summer and autumn, anlagen initiated after the winter rest become tendril primordia, as do those which have not developed sufficiently before winter to acquire a definite habit of growth. Those anlagen which have just begun to acquire the inflorescence mode of growth in

autumn develop into transition forms when growth recommences in spring. Differentiation of the flowers of the inflorescence takes place as the buds are opening in spring and occurs over the same and different inflorescences simultaneously, thus preventing further ramification. Hence it follows that the number of flowers that an inflorescence may produce is determined by the amount of growth made by the inflorescence prior to the differentiation of the flowers. The number of anlagen that differentiate as inflorescence primordia and the ultimate size of the inflorescences are largely controlled by the amount of growth made in summer and autumn. It is thought that the most suitable conditions to bring about differentiation into inflorescences are those inducing an early cessation of elongation growth in the summer and the rapid accumulation of starch in the wood. Experiments are now in progress to control the development of anlagen during summer and autumn by cultural means, and a second series to obtain more information in respect to the factors influencing anlagen differentiation and inflorescence primordia development.

205. HICKINBOTHAM, A. R.

634.8-1.453

Soluble salts in non-irrigated vineyards.

Dept. Agr. South Australia, bull. 279, 1933, pp. 217-23, bibl. 8.

In investigating a frequent cause of failure in vines, the progress of the "disease" was found to be as follows:—The tips and edges of the lower leaves were the first to show scorching and this worked slowly inwards until only the main ribs remained green, later nearly all the leaves becoming affected in some cases. New growth was weak and spindly, the margins of the leaves browning before reaching full development and the berries in many cases failing to ripen. In succeeding seasons the same vines were generally more seriously affected. The trouble was traced to the presence in the soil of excess of soluble salts. Owing to excess of sodium chloride a large amount of the sodium has combined with the clay over a great part of the area, forming soda clay, which is dense and heavy, sets like a brick, is hard to break when dry, and sticky when wet, and is only slowly penetrated by water. When wet it is definitely alkali—pH9 or higher—and forms a most unfavourable medium for plant growth. Discussing remedies the author eliminates drainage as being essentially the best solution but uneconomical at the present time. The worst patches might well be turned over to forage crops. Throughout the area a surface mulch should be maintained and weeds kept down in order to avoid evaporation. Stable and green manures are advisable to improve the soil texture and allow rain to wash the salts out of root reach. *Melilotus albus* or better King Island Melilot is suggested as a likely crop in this connection. Dressings of gypsum or lime should be tried experimentally. These should facilitate cultivation and allow the soil to be broken up before winter, so making it easier for the removal of salts by rain. Cultivation must initially be shallow so as to avoid bringing the soda clay up to the surface.

206. SNYDER, J. C.

634.8:581.145.1/2

Flower bud formation in the Concord grape.

Bot. Gazette, 1933, 94: 771-9, bibl. 12.

By his study of the morphology of this example of *Vitis Labrusca* and by projection drawings of the different stages reproduced here, the author is led to the following conclusion. "The data . . . indicate that cluster initiation occurs in the buds of the young shoots and continues in the newly forming buds throughout the growing season. Furthermore, subdivision of the differentiated clusters begins very soon after differentiation of the clusters, and continues until the following spring, when the buds begin to swell and flower formation is evident." As regards technique the author states that an acetic-formalin-alcohol killing fluid was used and that the penetration of the reagents and the sectioning of the buds was greatly facilitated by shaving off one face of each eye and removing the bud scales and hairs. Sectioning was further helped by treating buds with hydrofluoric acid and soaking the paraffin-imbedded specimens in warm water for 1-8 days.

207. THOMAS, J. E. 634.8-1.8 : 581.192

The diagnostic value of the chlorine content of the vine leaf.

J. Council Sci. and Indust. Res., Australia, 1934, 7 : 29-38, bibl. 8.

An investigation of the relationship of the soil chlorine content to the leaf chlorine in salt-affected areas of the Murray irrigation areas is recorded. The effects of excessive soil salinity commonly observed are premature bud burst, faulty setting, small leaf size, small berry size and low density of grape juice, premature wilting and leaf fall, faulty development and maturation of annual wood. The leaf reactions consist, in addition to small size, of early chlorosis followed by the development of necrotic areas along the leaf margins and between the veins. These necrotic areas increase until the chlorophyll-bearing area is limited to a strip along the veins. The damaged areas are invariably spaced in relation to leaf venation, and may appear in a few days in hot dry weather. The close connection between manifest salt injury, leaf chlorine and soil chlorine is shown. Hence the chlorine content of the leaf may be of considerable value in defining conditions in which the vine is growing. In making such diagnosis due regard must be paid to the following factors. Time of sampling (a chlorine absorption curve for the growing months is given as an interpretation), variability from vine to vine on soils of uniform salinity (as much as 20 per cent. has been recorded), variation of chlorine from leaf to leaf (the higher content of the older basal leaves compared with the younger leaves farther along the shoot has amounted to 33 per cent.), variability in the different parts of the leaf (an increase of concentration from 0.38 in the centre to 0.45 at the periphery in a single leaf has been noted). It is considered that concentrations beyond 0.5-0.6 per cent. of the dry matter in the latter part of the season may be considered indicative of excessive soil salinity.

208. MADER, —. 634.8

Der Weinbau in den noch unter Mandat stehenden deutschen Kolonien Afrikas.

(Vine growing in the old German African colonies.)

Tropenpflanzer, 1934, 37 : 17-25.

This is a discussion of the possibility and of the factors which influence the possibility of growing vines in Tanganyika. The chief vine-growing districts of the world lie between the 34th and 45th degrees of latitude. Tanganyika lies between the Equator and 12 degrees south, but its high altitudes and consequent moderate temperatures in many parts may make all the difference. Statistics [taken apparently from those published by the German authorities in 1912 at Dar es Salaam.—ED.] show that as regards temperature many districts at a height of from 1,100 to 1,600 m. present almost ideal conditions. It is noticeable that vines are successfully grown in Peru at an altitude of 1,200 m. A feature, the effects of which will need careful investigation, is, however, rainfall, its amount and time of occurrence. The actual number of rainy days varies from 60 to 183 days, most of the rain falling between January and May. The amount is normally well over 1,000 mm. The resulting humidity of 69% to 85% may be found to encourage fungous diseases to such an extent as to render vine growing precarious. The vine is not very particular as to soil and the East African soils would appear eminently suitable. At the same time the necessity for working on American stocks in the event of phylloxera attack is bound to arise and these stocks are much less tolerant of bad soil conditions. The use of such stocks will also necessitate the establishment of grafting establishments. It is suggested that the vines will do best in East Africa if trained high as in Italy and France. The labour problem certainly needs consideration. In Germany it is considered that one skilled man can with the help of one to two assistants according to season work 1 hectare (2.47 acres) of vines. The difficulty of getting farmyard manure will necessitate investigations being carried out with green manures and artificials. Water must be available for spraying purposes. As regards varieties it is suggested that some might well come from South Africa, e.g. the Green Grape, Riesling, Brun Fourca, Hanepoot, and Muscat of Alexandria being suggested as table grapes, and as wine grapes Malvasia, Muscatel, Cherry Olorso, Hermitage.* As rootstocks Rip. × Rup. 101.14, 3,306 and 3,309 have done well at the Cape, while the new Austrian stocks Berl. × Rip.

* Most of these are not listed by Perold in his "Treatise on Viticulture."—ED.

Kober 5 BB and Teleki 8B are worth investigation. The writer ends with the translation of an article on vine growing in Madagascar which appeared in the *Revue de Botanique Appliquée et d'Agriculture Tropicale* of July, 1933. This gives an account of the history and present system of viticulture in Madagascar, where climatic and soil conditions bear a certain resemblance to those of Tanganyika, though probably the latter are not quite so favourable. In conclusion it is suggested that the only way to test possibilities is to plant up trial vineyards in selected parts, and thus by employing tested methods and skilled workers give the venture a fair test.

209. LARGILLIER-SEIBEL, H. J. 634.835.094
 Restriction et interdiction de la culture des hybrides. (**Restriction and prohibition of the growth of hybrid vines.**)
Prog. agr. et vit., 1934, 101 : 277-83.

The doom of the direct producers would appear from this article to be sealed. In Bulgaria, Hungary, Italy, Tunis, Portugal and Roumania legislation has either entirely forbidden their cultivation or has taxed it so heavily as to have the same effect. In other countries little enough encouragement is given to their cultivation but in certain others, notably Germany where their cultivation by the ordinary grower is being rigorously suppressed, and in Switzerland and Austria, breeding work on the subject will still be possible. The author considers such work to be of the utmost importance and notes the great progress already made by such men as his namesake Seibel, Zweigelt and others. The present position in France is that by the law of 8th July, 1933 replanting of vineyards which are grubbed can only be done with varieties whose names appear on the official list drawn up by the Agricultural Office of the Department. This the author considers will be sufficient to stop all further research on the subject of direct producers, as Departments are not likely to put a new direct producer on the list, however full of promise it may be, since long trial is obviously essential. [Direct producers would appear to have suffered greatly from excessive praise prematurely bestowed, followed often by disappointment when expectations have not been realized. The "foxy" taste is, moreover, very hard to eradicate and disease resistance is subject to environmental influence.—Ed.]

210. GUILLOU, R. 634.835.094
 Nécessité d'apporter plus de méthode dans la substitution des hybrides P.D. aux plantes français. (**The need for greater care in replacing French vines by direct producers.**)
Prog. agr. et vit., 1934, 101 : 323-7.
 VERNAY, P. 634.835.094
 A propos de producteurs directs. (**Direct producers.**)
Ibidem, 1934, 101 : 379-80.

In view of the article by Largillier-Seibel also abstracted in this number these two discussions on the subject of the direct producer are worth noting. In both it seems to be taken for granted that direct producers will continue to be used in France. In the first a strong plea is uttered for a better control of their spread, so that the reputation of French viticulture may not suffer, in the second the author suggests that all direct producers are blamed for the sins of a few and that legislation suppressing their use favours the large grower at the expense of the small.

211. VINET, E. 634.8-1.8
 La fumure annuelle de la vigne et l'accumulation des effets fertilisants, d'après le diagnostic ligneux. (**The accumulation of manurial elements in the vine resulting from annual manuring and shown by wood diagnosis.***)
Prog. agr. et vit., 1934, 101 : 137-43.

Summarizing the results of the early application of a complete fertilizer containing varying amounts of K_2O , P_2O_5 and N to the experimental vineyard at Savennières, the author notes that such treatment :—(1) Did not result in increased nitrogen content as the years went on.

* Analysis carried out at the base of lignified shoots showing three buds.

(2) Did result in increased P_2O_5 content especially when large quantities of potassic fertilizer were used in conjunction with the phosphate (superphosphate). (3) When KCl was used, actually resulted in the amount of potassium in the wood being doubled. The SO_4 ion of K was found superior to the Cl ion in sugar production, but not in set of fruit. (4) The persistent increase in the ratio P_2O_5/N during the first 4 years of the trial and that of potassium in the wood, which still persisted after 5 years, definitely prove that annual fertilizer applications do result in an accumulation of fertilizing elements. This fact is beyond doubt, but we are not as yet in a position to state the exact mechanism of the operation. Still the determination provides us with new data wherewith to solve the problem of the unexpended value of fertilizer and of its equilibrium, since we now see that the accumulation of fertilizing elements depends less on the amount of fertilizer used by the plant than on the continued supply of fertilizer and on the form in which it is given. Finally a consideration of the changes wrought in the mineral composition of the wood by annual manuring and the consequent resultant changes in quality and quantity leads us to ask how far these effects are permanent in the vine and whether in some cases they are actually acquired. In the light of wood analysis data mineral nutrition appears to us basically to affect the question of vine improvement by selection. A rational and persistent system of vine manuring may be of great help in such work.

212. WOOD, M. N.

634.51 : 581.162.3

Pollination and blooming habits of the Persian walnut in California.

U.S. Dept. Agr. tech. bull. 387, 1934, pp. 56, bibl. 14.

Some 17 leading or unusual varieties of the Persian walnut (*Juglans regia*) were tested for self and cross fertility and sterility under different climatic conditions. Detailed studies were made to ascertain the relative time of blooming of the pistillate and staminate flowers and the possible relation of this factor to crop production. Other factors affecting pollination were considered. All 17 varieties proved to be self fertile but to have dichogamous tendencies, 13 being completely dichogamous in some seasons and places. Dichogamy was most evident in young trees but persisted even in very old trees, the degree of protandry or protogyny exhibited varying with conditions. It is found that the coastal climate with a mild winter and prevalence of fogs and cloudy weather at certain times tends to increase protogyny and modify protandry, the more extreme climate of the interior having an opposite effect. Under given conditions varieties are consistent in relative time of blooming. The length of blooming may vary from a few days up to $2\frac{1}{2}$ months according to the weather. Since under certain conditions the fact of dichogamy may mean that self-pollination cannot take place, cross-pollination may be advisable. The best groupings for the purpose combine intermediate and early varieties or intermediate and late varieties. The viability of walnut pollen varied greatly, viz. from 0 to 80%, the average being 23%. Tests showed that pollen could be carried through several rows of trees. An instance is noted of the parthenogenetic production of nuts on the Payne variety. The percentage of set was small but the total number of nuts was sufficient to warrant harvesting.

213. HAAS, A. R. C.

634.51-2.191

Walnut yellows in relation to ash composition, manganese, iron and other ash constituents.

Bot. Gazette, 1933, 94 : 495-511, bibl. 16.

Samples of bark and leaves were taken from healthy and unhealthy *Juglans regia* trees. It was found that the ash of the diseased bark was higher than that of healthy bark. Calcium, magnesium, manganese, and inorganic phosphate were also generally higher in the diseased bark. Similarly, leaves affected by yellows showed a higher content of magnesium, manganese, iron and inorganic phosphate than did healthy leaves. Attempts to grow walnut seedlings in Hoagland's solution, to which increasing concentrations of manganese sulphate were added, resulted in some cases in a yellow discoloration of the leaf, but the condition induced, though slightly resembling yellows, was far from being typical of the disease.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

214. BRET, J. 634.1/8-2.111
 Un nouvel appareil de défense contre les gelées blanches. (**A new apparatus for combating white frosts.**)
Prog. agr. et vit., 1933, 100 : 522-8.
 and,
 BRET, J. 634.1/8-2.111
 La défense contre la gelée blanche. (**Protection against white frosts.**)
Ibidem, 1934, 101 : 164-6.

In the first article is described a new type of anti-frost device in which heavy gas clouds are released by chemical reaction of acid and base. The gas does no harm to animals or to the most delicate plant growth, and containing particles of sulphate of ammonia it is said to have a distinctly fertilizing effect. The original "P.M.B." apparatus suffered from comparative immobility and was not automatically regulated. Later patterns, "P.M.B.33", are more mobile and can be rolled about from place to place as a unit (wt. 140 kg.). The optimum cloud delivery is now also automatically regulated for ordinary occasions, while a device is attached by which a larger dose can be emitted in case of necessity. The apparatus is said to be very strong, only need cleaning once a year and to be proof against the action of acid. Its cost for one night is less than 300 frcs. and its area of protection 12 to 24 acres. Field trials in the Barsac and Pujol area indicate the superiority of the method to the old, crude oil burning heaters. It was found, moreover, that not only was the fall in temperature considerably less when such a system was used, but also rapid thawing in the sun's rays was avoided. The most appropriate time to use the apparatus will normally be from 2 hours before till 1 hour after sunrise. A patent has been taken out by the makers, the Société Anonyme des Forges et Fonderies de Pont-à-Mousson, Belleville, Meurthe et Moselle, France. In the second article the writer gives notes on a further new type of apparatus made by the Société Industrielle de Tourcoing in which the smoke cloud is formed from 2 liquified gases. In this case one of the gases acts as the base and the smoke finds itself neutralized by the same reaction which has produced it, which means a definite economy. The whole outfit weighing only 90 kg. is mounted on wheels. It is said to be very simple and not to require experts to handle it. The gases are contained in cylinders each containing an hour's supply, after which they merely need replacing, this being a very simple operation. The cylinders of gas are obtainable from the Usines Kuhlmann of Marseilles.

215. KESZLER, O. W. 634.1/8-2.111
 Die Bekämpfung von Frostschäden. (**Frost protection.**)
Obst. u. Gemüsebau, 1934, 80 : 57-8.

Methods tested by the German Ministry of Agriculture include the following :—Acid clouds and ammonium chloride clouds, which afford excellent protection when the danger from frost exists in the place where the frost originates as on flat plains, but are not successful in open stretches in hill country when the cold air is carried as a mountain wind. The oil heaters of American citrus lands find their counterpart in the crude naphthalene heaters used in Germany often in conjunction with brown coal. Normally the heater is filled with a little wood wool at the bottom ; this is followed by a shovelfull of raw naphthalene and then by brown coal briquettes up to the top. The oldest method used is covering up the plants, but this is generally too expensive. A further measure of frost protection which needs more investigation but offers promise of success is the provision of artificial rain during danger nights. The Institute of Climatology at Trier has had considerable success with the following measures :—ground covers, afforestation of areas where frost originates, formation of reservoirs in places where frost makes its entry, the establishment of wind screens.

* See also 150, 190, 191, 192, 213, 261, 303.

216. ATANASOFF, D. 634.11-2.8

Bitter pit of apples.*

Yearbook Univ. Sofia, Agr. Faculty, 1933-34, 12 : 31-67. bibl. 48.

The author after briefly noting and commenting on the many theories propounded by different workers to account for this disease summarizes as follows :—" Evidence is presented here which tends to show that bitter pit of apple is a virus disease. An infectious leaf variegation of apples recently has been described by Bradford and Foley. They review the former records of the same disease to which should be added this of Valleau. The symptoms of this disease resemble the leaf symptoms of plum pox, which on the fruit produced symptoms resembling closely those of bitter pit of apple. In two cases McAlpine has shown experimentally that bitter pit of pear is transmitted by grafting and budding, but gave a wrong interpretation to his results. There exists a great, often complete resemblance between bitter pit of apples and a number of other virus diseases of plants, such as :—potato and tomato streak, potato net necrosis as described by the author, plum pox, buckskin of cherry, red suture and bumpy peaches, black measles of grape, etc. Once infected apple trees develop bitter pit in a more or less severe form every year. Bitter pit occurs in some cases on single trees surrounded by pit free trees of the same variety. It may affect only part of a tree or only a single branch on a tree. Apple seedlings have often been reported as being pit free, but when grafted with susceptible varieties develop pit. Just as the " curl " of olden days covered all virus diseases of the potato, so does the " bitter pit " of to-day cover a group of related virus diseases, which can be separated only after a careful study."

217. ZELLER, S. M. 634.75-2.8

Crinkle disease of strawberry.†

Oregon Agr. Exp. Sta. bull. 319, pp. 14, bibl. 8.

This is a semi-popular account of the disease. It has caused a great falling off in fields of the Marshall variety and is a serious factor in the propagation of Corvallis and Ettersburg 121. It affects other cultivated varieties as well as the wild field strawberry, *Fragaria cuneifolia*, and the beach strawberry, *F. chiloensis*. The disease is transmitted to the runners from the mother plants and *Myzus fragaefolii* is also proved to be a vector. Plants produced from seed of infected plants were healthy until artificially infected by means of aphids. The elimination of the disease from planting stock is best achieved by the selection of outstanding, healthy plants in plantings a year or more old, the symptoms being usually masked during the first few months after planting out runners. A system of artificial inoculation is described whereby freedom of supposedly healthy plants from crinkle may be tested. [From author's summary.]

218. WILCOX, R. B., AND BECKWITH, C. S. 634.76-2.8

A factor in the varietal resistance of cranberries to the false blossom disease.

J. Agr. Res., 1933, 47 : 583-90, bibl. 8.

These experiments indicate very strongly that the varying degree of attractiveness of the different varieties of cranberry to the insect vector of the disease, *Ophiola striatura* (= *Euscelis striatulus*) the blunt-nosed leaf hopper, decides the rapidity and extent of the spread of false blossom in those varieties. Conversely the same evidence strongly suggests that the apparent resistance of certain varieties is due, partly at least, to their unattractiveness to this leaf hopper. The following descending order of susceptibility was determined :—Howes and Centennial, Champion, Early Black and McFarlin.

219. WORMALD, H. 634.22-2.314

Bacterial diseases of stone fruit trees in Britain. V. Some field observations and experiments on plum bacterial canker.‡

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 147-53, bibl. 4.

The author notes that, since the bacterium is known to infect the leaves in spring and summer, spraying the foliage during summer should check the leaf-spot phase of the disease, while a

* Since going to press a further article by the same author has been received entitled " Bitter pit of pome fruits is a virus disease." *Ibidem* 1934-5, 13 : 1-8, bibl. 5.

† See also Imperial Bureau of Fruit Production tech. comm. 5, noted in *H.A.*, 1934, 4 : 1 : 149.

‡ *Pseudomonas mors-prunorum*.

thorough drenching of stems and branches about the time of leaf fall should prevent stem infection. Bordeaux mixture would be suitable for the purpose. The efficacy of such methods has, however, not yet been tested, and in this paper are described attempts to attack the problem along the lines of orchard practice, the use of resistant stems and soil conditions. He summarizes as follows:—(1) Pruning or cutting back plum trees in autumn is to be avoided, as bacterial canker infection may arise at the cut surfaces. (2) Inoculation experiments and field observations have shown that Victoria is subject to severe infection by the canker bacterium when worked on any one of four commonly employed stocks for plums, viz. : Brussels, Brompton, Common Plum and Myrobolan B. (3) The variety Denniston's Gage, that shows apparent resistance in the plantation, succumbed to artificial inoculation as readily as Victoria, while artificially induced cankers on Brussels stems were distinctly smaller than those on Victoria stems. (4) Victoria when worked high (stem the same as rootstock) on Myrobolan B. or Common Plum had a lower percentage of trees killed by bacterial canker than when worked low (stem Victoria). (5) The possibility of employing a resistant variety as stem and framework for a more susceptible but more valuable variety is discussed. (6) On manurial plots, potash, applied to budded trees during the year the buds grew out, had no restraining effect on the incidence and development of bacterial canker on the maiden trees.

220. MOORE, M. H.

634.11-2.42

Some field observations on apple canker (*Nectria galligena*).*East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 166-75.*

Observations for some 5 years on Cox's Orange and 3 years on Stirling Castle apple trees indicate that spray treatment had little effect on the cumulative incidence of apple canker. Both varieties showed greater susceptibility on rootstocks XVI and XIII than on the 9 other stocks used. The author stresses the necessity for removing all infected tissue. When this was done no re-infection occurred of painted or unpainted wounds.

221. FITZPATRICK, R. E.

632.42:634.25

The life history and parasitism of *Taphrina deformans* (Peach leaf Curl).*Scientific Agriculture*, 6 : 1934, 305-26, bibl. 11.

(1) The life history and parasitism of *Taphrina deformans* have been investigated. (2) Carefully timed spraying experiments indicate that infection occurs in the spring just as the leaf buds are unfolding. In the Niagara district summer infection rarely, if ever, occurs. (3) The ascospores or sprout conidia derived from them have been shown to persist through the summer and winter lodged on the twigs and buds of the peach. From there they are washed to the opening leaf buds by the spring rains. (4) Penetration may occur from either surface of the leaf. A spore about to initiate infection produces a short hypha which attaches itself to the leaf surface, and the contents of the spore pass through this into the cuticle where a limited growth is made. (5) From the cuticle the fungus penetrates between the epidermal cells and for a time grows out in all directions among the parenchyma cells below. (6) The mycelium is irregular and at first is very thin and without septa but later becomes much thicker and numerous cross walls are laid down. (7) Invaded tissues become hypertrophied, the response being apparently confined to the cells in contact with the mycelium. (8) The spores possess a single haploid nucleus which divides as the bud is being formed and the daughter nucleus migrates into the bud. When infection occurs this daughter nucleus appears to assume a conjugate relationship with the mother nucleus and both migrate into the penetration tube. Subsequent divisions are conjugate and one or more pairs of nuclei are found in each cell when the mycelium becomes septate. Thus the entire life cycle can be initiated by a single spore and no copulation of sprout conidia such as has been reported for *Taphrina epiphylla* and *T. Keibahni* occurs in this species. [Author's summary.]

222. **BERKELEY, G. H.** 634.75-2.4

Strawberry root rot.*

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 154-5.

The author established the presence in Kent and Sussex strawberry plantations of certain elements in the soil which were causing root rot in the plants. Isolations were made from lesions on affected roots and gave rise to numerous fungi, the most common of which were *Coniothyrium*, *Hainesia*, *Ramularia*, and *Fusaria*. Inoculation of sterilized soil with pure cultures of *Coniothyrium* and *Ramularia* resulted in the first case in the death of several of the newly planted runners planted in the sterilized soil and in the case of *Ramularia* in some discoloration of roots and a few lesions.

223. **MILLER, P. W.** 634.51-2.314

Fourth report of progress on studies of the control of walnut blight in Oregon.

Proc. 19th Ann. Meeting Western Nut Growers Assoc., 1933, pp. 139-52, bibl. 4.

Data from the 4th year's trials of control methods for *Bacterium Juglandis* and conclusions arising therefrom are discussed. The tests were made in seedling and in grafted Franquette walnut groves. In seedling groves, although control was finally effected by means of continued spraying with bordeaux over a long period, the practical difficulties involved in timing the sprays properly owing to the great variation which exists in the blooming periods of individual seedling trees as also to the fact that the early blooming of many seedlings results in the exposure of the young nuts to many early season rains as well as the large number of treatments necessary tend to discourage extensive use of this treatment. In grafted groves on the contrary excellent control was obtained by at least 2 properly timed applications of bordeaux mixture. These were most effective when made just before the blooming of the female flowers and immediately after bloom when small, brown spots were first noted in the stigmas or blossom ends of the nuts. In Western Oregon bordeaux mixture 3-3-50 appeared to be strong enough, if applied at the times mentioned above. Efficient spraying has resulted apparently in increased yields and improvement in quality of crop. Less exhaustive tests were made with other spray materials, but no conclusive results were reached. Further tests are necessary to reduce leaf burn and to determine the best times and number of sprayings necessary under different situations and conditions met with in different years.

224. **COLE, J. R.** 634.521-2.42

Liver spot disease of pecan foliage caused by *Gnomonia caryae pecanae* nov. var.

J. Agr. Res., 1933, 47 : 869-81.

The fungus attacks trees of low vitality, particularly those thickly crowded or growing in soil low in humus. It seems to thrive best in climates of high temperature and low rainfall. Varietal resistance was noted, Schley and Georgia Giant being highly resistant, Stuart, van Deman & Pabst very susceptible. Perfect control was achieved on the Pabst variety by one application of 4 : 6 : 50 bordeaux mixture given on May 27th, i.e. about 17 days after the discharge of the ascospores.

225. **YOTHERS, M. A.** 634.1/2-2.754

Biology and control of tree hoppers injurious to fruit trees in the Pacific Northwest.

U.S. Dept. Agr. tech. bull. 402, 1934, pp. 45, bibl. 35.

The most important of these are *Stictoccephala inermis*, *Ceresa basalis* and *C. bubalus*. After describing the life histories of these pests the author deals with the efficacy of control measures. He considers that spraying the eggs with a 4 per cent. oil emulsion or miscible oil affords the most

* See also *Imperial Bureau of Fruit Production tech. comm. 5*, noted in *H.A.*, 1934, 4 : 1 : 149.

satisfactory control. This destroys enough eggs to effect reasonable control. Lime sulphur proved ineffective. Where oil spraying is undesirable, it is thought that clean cultivation may be worth considering in cases of severe injury.

226. STEER, W. 634.71-2.76

Studies on *Byturus tomentosus* Fabr. IV. 1933. Experiments on the control of the raspberry and loganberry beetle.

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 188-96, bibl. 6.

Satisfactory results were achieved on raspberries and loganberries by one spraying with a solution of sufficient finely ground derris to give a rotenone content of approximately 0.005 per cent. and 5 lb. of soft soap per 100 gallons. As regards later picked logans an additional spraying shortly before picking was also found useful. Small trials on cultivated blackberries indicated that the pest can be controlled there also by a single spraying as above. [From author's summary.]

227. MASSEE, A. M. 634.75-2.654.2

Investigations on the control of the strawberry tarsonemid mite.

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 181-7.

An account is given of the effects of different treatments on mite control and subsequent life of infested strawberry runners. Briefly, dipping in 3% lime-sulphur was not successful as a control. Treatment for 20 minutes with water at 110° F. was most successful, the control achieved being adequate and the plants after an initial check growing away healthily. Control was not so pronounced when dipping was for 10 minutes only. In a further series of experiments made in the autumn of 1932 runners were dipped for 10 minutes and for 20 minutes in water at temperatures of 90, 100, 105, 115, 120 and 130° F. The plants were Royal Sovereign and were infested with mites. The results of growth and mite control thereby achieved showed that treating at a temperature of over 112° endangered the plants and at one lower than 108° did not kill the mites and their eggs. Both red spider and strawberry aphids were found to be killed by the warm water treatment and the author considers it likely that the strawberry eelworm will also yield to the same treatment. [See, however, Christie's article on Strawberry Dwarf, being *U.S. Dept. circ. 297, H.A., 1934, 4 : 1 : 68*, in which treatment for 30 minutes at 118° F. is advocated. Here Christie notes that the control was successful, but does not mention the subsequent history of the treated plants.—Ed.]

228. HEY, G. L., AND STEER, W. 634.11-2.793

Experiments on the control of the apple sawfly (*Hoplocampa testudinea* Klug.). The results of one season's field trials and some considerations arising from them.

East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 197-216, bibl. 11.

The authors stress the fact that they are reporting on the experimental results of one season only. On these results they draw the following conclusions as to the susceptibility of the several stages of the pests to the various sprays tested:—(a) The adult is susceptible to a derris dust. (b) The egg (at any stage of its incubative period) susceptible to nicotine and soap—a fact of vast importance in commercial spray practice. (c) The newly hatched larva appears to be equally susceptible to nicotine and to derris (each with soap) at the concentrations used, but in the case of nicotine (applied a week after petal fall) it is difficult to differentiate exactly between an effect on the egg and an effect on the larva. Arsenate of lead and barium silicofluoride (each with gelatine) were of about equal value at the concentrations used, and were each much less efficient than nicotine. (d) The migrating larva. Secondary infestation by migrating larvae, an important phase of sawfly attack, was arrested by a derris dust, by derris and soap and by nicotine and soap, each applied eighteen days after petal fall. The performance of certain wetters and spreaders and the effect of sawfly control on yield are also briefly discussed.

229. STEARNS, L. A., AND OTHERS. 634.11-2.78-2.951.23
Experience, during 1933, with arsenicals and arsenical substitutes applied on apple for control of codling moth.
Trans. Peninsula Hort. Soc., 1933, 23 : 5 : 20-28.

Owing to the spread of codling moth and the stringent regulations as to the permissible amounts of arsenic and fluorine on apples, which must not exceed 0.019 grain of lead and 0.010 grain of arsenic or fluorine per pound of fruit, attempts are being made to find economic substitutes for lead arsenate. Various nicotine oils and other compounds have been tried against the different broods of the moth. As a result the authors report that there is still no insecticide more effective against this pest than lead arsenate. If this is used for first and second broods on late apples, the fruit will almost inevitably require washing. If it is preferred to use a substitute, a treatment consisting of lead arsenate for the first brood and nicotine oil sprays for the second brood should prove equally effective but will be more expensive in material and labour.

230. HOUGH, W. S. 634.11-2.78-2.951.23
Codling moth control in Virginia.
Trans. Peninsula Hort. Soc., 1933, 23 : 5 : 35-8.

The author considers that reduction of infestation by this pest will not come until growers are willing to take the following measures :—(1) scraping loose bark from trees in the dormant season and banding between June 1st and June 15th, (2) reducing the packing shed menace by storing packing boxes in between seasons, (3) daily disposal of culls during picking season, (4) more thorough spraying, which must be both early and late, the later applications necessitating fruit washing. Lead arsenate still appears to be the best insecticide for the purpose.

231. HENDERSON, M. R. 632.951.1
The sources of "tuba" in the Malay Peninsula.
Malayan Agr. J., 1934, 22 : 125-30.

A key and description to some six varieties of *Derris* commonly cultivated in Malaya, based on leaf characters and habit of growth. The importance of easy recognition lies in the fact that the toxic properties of *Derris* vary with the variety. The types are illustrated by 8 clear drawings.

232. MOORE, M. H. 634.11-2.95
A field spraying trial of combined fungicide-contact insecticide sprays in 1933.
A progress report.
East Malling Res. Sta. Ann. Rept. for 1933, A.17, 1934, pp. 156-65, bibl. 7.

Very good control of apple scab, red spider and sawfly was given on Cox's Orange Pippin in 1933 by a spray programme in which lime sulphur was used in combination with nicotine, with sulphite lye as wetter and spreader. The effect of the nicotine was apparently ovicidal. The use of derris in place of nicotine was not so effective against sawfly. Control of the caterpillars of the Winter Moth group by the contact insecticide was poor. Methods of treatment are detailed and results are tabulated.

233. CUNNINGHAM, G. H. 634.11-2.952
Effects on apple trees of lime sulphur following bordeaux mixture.
New Zealand J. Agr., 1934, 48 : 15-7, bibl. 2.

The belief that leaf and fruit injury results when lime sulphur is applied to trees sprayed with bordeaux mixture unless a considerable time interval is allowed to elapse between applications is still held by many orchardists in spite of much published evidence to the contrary. To endeavour finally to settle this question a series of field and laboratory experiments have been undertaken by the Plant Research Station, Palmerston North. The apple varieties used were Delicious, Jonathan, Sturmer, Rome Beauty. The compounds were (a) lime sulphur alone at 0.1% concentration, (b) a precipitate obtained by combining equivalent amounts of copper sulphate and 0.1% lime sulphur; (c) a precipitate obtained by combining equivalent amounts of bordeaux mixture and 0.1% lime sulphur; (d) a solution containing half the amount of copper

sulphate used in (b) dissolved in 0.1% of lime sulphur. One tree in each series was sprayed with water daily for 14 days with a view to increasing the possibility of injury. No injury was observed with (a) (b) or (c). With (d) slight leaf scorch appeared on Sturmer and Delicious. This is attributed to the soluble copper compounds and, judging from these experiments, is only liable to appear when lime sulphur is in considerable excess of copper salt. It is pointed out regarding results of treatments (b) and (c) that, if the strengths of copper sulphate or bordeaux had been applied without the lime sulphur, injury would have resulted. Thus combination produces sprays as safe to use as 0.1% lime sulphur, but a heavy adhesive black deposit lasting for weeks on fruit and leaves when the spray is prepared with copper sulphate also results, and as it appears less fungicidal to black spot than 0.1% of lime sulphur the author questions whether anything is to be gained by combination. It is concluded that injury is not likely to follow when apple trees are sprayed at either 5-4-50 or 3-4-50 bordeaux mixture at green tip followed by 0.2% lime sulphur at pink or pre-pink stages.

VEGETABLE GROWING.*

234. MINISTRY OF AGRICULTURE, LONDON. 635.1/8-1.544

The cultivation of vegetables in frames.

Min. Agr. bull. 65, 1934, pp. 60, bibl. 5, 1/-.

Modern practice is introduced by a short, interesting historical survey. The place of frames in modern commercial practice is then considered and diagrammatic illustrations are given of frames and fittings which have proved economical and sound. The heating of frames is discussed and references are made to articles on the latest research work which deals with this important subject. Hints on methods of frame cultivation of crops in England include selection of site, hot and cold frames, seedling raising, protection of tender crops by cloches and glass erected in different forms, forcing pits for asparagus and seakale. Pages 40-59 are devoted to special features of frame cultivation in France and Holland with a few notes on that in the Atlantic Coast States of the U.S.A.

235. MINISTRY OF AGRICULTURE, LONDON. 635.1/8-1.8

The manuring of vegetable crops.

Min. Agr. bull. 71, 1934, pp. 63, bibl. 23, 1/-.

The bulletin is written primarily to present to the market gardener in convenient form the findings of research and practical experience on the subject. The building up of the soil is all important and notes are given on the effect of stable manure, artificial manure, green manures especially lupins, mustard, turnip and rape, sheep folding, rotation of crops, subsoiling and bastard trenching, liming. A discussion follows of the different types of organic manures, e.g. guano, fish waste, seaweed etc., etc., and of the inorganics including the compound fertilizers now on the market in various forms. The different types of soil on which vegetables are grown and their probable manurial requirements are noted and finally suggestions are made as to the manuring which is likely to be beneficial in the case of most of the commonly grown market garden vegetables.

236. BOSWELL, V., AND OTHERS. 635.64

Descriptions of types of principal American varieties of tomatoes.

U.S. Dept. Agr. misc. publ. 160, 1933, pp. 23+30 plates.

This is the first of a series of publications planned to deal in due course with types of American vegetables, in the hope of laying down some standard which may be generally accepted by growers and the public and help to eliminate the existing confusion and disagreement as to the characteristics of particular varieties. Particulars are given for average performance of ordinary,

* See also 162, 287.

good, unpruned plants on the following characters of the varieties named :—chief use, season, length of growth period, plant and leaf size, leaf colour, growth habit, foliage density, colour of immature fruit, weight of fruit, shape of fruit, corky ring, stylar scar, outside colour of fruit, inside colour, number of cells and their arrangement. The varieties described are Earliana, Bonny Best, Gulf State Market, Globe, Marglobe, Early Detroit, Greater Baltimore, Stone, Santa Clara.

237. WILSON, P. W., AND GEORGI, C. E. 631.829 : 631.544
Methods for controlling the environment of greenhouse plants.
Bot. Gazette, 1933, **94** : 346-63, bibl. 21.

Devices and methods to change environment within the greenhouse are described and discussed. They include the following :—regulation of CO₂ supply and of atmospheric humidity ; the supplementing of natural sunlight in winter ; regulation of temperature by steam heat, ventilators, electric fans and frequent sprinkling ; shading from sun by means of shades and paint ; prevention of growth of algae by distribution of copper sulphate through the house.

238. MANN, M., AND SCHANDERL, M. 631.544 : 631.829
 Studien über Kohlensäuredüngung in Gewächshäusern. (**Studies on CO₂ manuring in greenhouses.**)
Gartenbauwissenschaft, 1934, **8** : 497-514, bibl. 19.

An examination of the Reinau method is made, especially of the way in which the CO₂ is distributed. The height of the roof ridge and the tightness of the glass were found to affect the success of the method considerably. The lower and flatter a greenhouse, the more suitable it is for artificially supplying CO₂. In experiments by the authors, plant tables were covered with various substances such as compost and turf, turf watered with liquid manure, etc., and on this plants were set. The CO₂ content of the air around these plants was then measured. It was found possible in this way to increase the normal CO₂ content 4 to 5 fold in a closed greenhouse. The best CO₂ producer was found to be turf treated with liquid manure or with hakaphos. The above treatment would appear to have many advantages over that of Reinau.

239. VOGEL, F. 635.1/8-1.87
 Die Wirkung des Iods auf verschiedene Gemüsearten. (**The effect of iodine on vegetables.**)
Obst u. Gemüsebau, 1934, **80** : 19-21 and 41-2.

A preliminary note on these experiments at Weißenstephan appeared a year ago. The full data have now allowed of amplification and modification in the conclusions then reached (*Ibidem*, 1933, 79 : 87-8, *H.A.*, 1933, 3 : 3 : 351). The experiments were made in pots and in the field and the effect of iodine was noted in some 16 different vegetables. Vegetables vary greatly in their power of absorbing iodine. Thus lettuce, endive, spinach, mangold, radish, carrot and beetroot were found to store iodine in large quantities. Savoy cabbage, kohlrabi and tomatoes stored it but to a less degree. The other vegetables tried did not yield definite results, though there was indication of the inability of cauliflower, cabbage, certain radish varieties, celery, bush beans and cucumbers to store it in any quantity. Generally speaking the addition of iodine to the soil did not appreciably affect the amount of crop. Results achieved show that the iodine content of vegetables can be increased by the application of iodine to the soil and that these applications are best made in a concentrated form on one occasion rather than in dilute solutions at various times.

240. MILLER, L. P. 581.192 : 631.811.9
Effect of manganese deficiency on the growth and sugar content of plants.
Amer. J. Bot., 1933, **20** : 621-31, bibl. 9.

The plants, which included among others lettuce, cabbage, tobacco and tomatoes, were grown in sand cultures. All were adversely affected by withholding manganese. Manganese deficient plants were much lower in sugar than those which received this element even in small quantity.

Results indicate that manganese plays an important rôle in sugar formation and sugar metabolism. It was found possible to add the manganese by direct injection of manganese sulphate into the stem.

241. MINISTRY OF AGRICULTURE, LONDON.

635.1/8-2.1/3

Vegetable diseases, a brief summary.

Min. Agr. bull. **68**, 1933, pp. 38, bibl. 156, 9d.

The symptoms of the more common diseases of the ordinary vegetables grown in this country are described and notes given as to control measures. It is somewhat depressing to find that often no remedy is suggested or the remark is made "successful control measures have not yet been worked out." Still it is a step forward to get hints as to the disease which is probably attacking one's vegetables, and in many cases to be informed of efficient control measures and of the most important articles in English dealing with the subject. The popular and scientific names of the diseases are given when possible.

242. BEWLEY, W. F.

632.19 : 635.64 + 635.63

Some physiological disorders of glasshouse crops. Being paper I at the meeting

of the Association of Applied Biologists held in London on December 1st, 1933.

Ann. Appl. Biol., 1934, **21** : 319-22.

Disorders are due to many causes including adverse soil conditions of texture, moisture and temperature. The author deals with some eight or nine disorders found in tomato and one in cucumber. *Cucumber disorder*.—Damping off in cucumber is said to occur when a rather large proportion of the young cucumbers formed shrivel up and die. It is due to a weakened constitution induced by imperfect root development, root decay or the strain of crop production. When serious the plants should be rested by ventilating the houses and allowing the beds to dry for 7-10 days, only damping down the house sufficiently often to maintain the foliage. *Tomato disorders*.—(1) Blossom end rot. This is characterized by a dark hard brown patch on the outside of the fruit. It is caused by an upset in water balance between foliage and fruit. If the plant has a healthy root system and the soil is kept damp, it should not occur. Excess of nitrogenous manure appears to aggravate the trouble. (2) Bronzing of the tissue just below the skin is probably due to excessive top growth followed by a check due to hot dry soil. (3) Blotchy ripening, bad penny or waxy patch are terms used to denote greenish orange patches on the fruit caused by deficiency of nitrogen and potash. (4) Green back, a condition in which a green patch develops round the stalk end, is also partly due to potash deficiency and partly to the action of the sun in hot years when the condition is most frequent. Artificial shading of the glass is of considerable help. (5) Blossom drop and dry set are associated with faulty development of flowers, the former being due to dry soil, the latter to failure of pollination under conditions of humidity insufficient for germination of the pollen grains. (6) Hollow fruit is a disorder arising from irregular development due to alternating periods of rapid and slow growth. (7) Oedema and dropsy are the names given to a condition which may arise in a dull damp house where transpiration is low: it is marked by the presence of furry blisters on the undersides of the leaves and fruit stalks. (8) Marketing troubles such as mottling and softness of fruit are liable to occur, the first when the temperature is too high, so that proper formation of red pigment is inhibited, the second when ventilation of the boxes is bad.

243. GUBA, E. F., AND HOLLAND, E. B.

635.63-2.944-2.952.2

Effect of hydrocyanic acid gas on cucumber plants previously sprayed with copper fungicides.

Massachusetts Agr. Exp. Sta. bull. **303**, 1933, pp. 16, bibl. 15.

The disastrous results arising from the use of HCN for fumigation led to investigations on the differing effects of this gas following different copper spray treatments. The authors discuss the type of injury caused by HCN fumigation following treatments with a large number of copper sprays such as lime bordeaux, sodium carbonate and copper sulphate, sodium hydroxide

and copper sulphate, dry bordeaux substitutes, stainless copper sprays, various copper fungicides and lime. Results are discussed and the following conclusions are reached :—The presence of free lime or soda in the copper spray increases the degree of injury, but injury may occur without it. The danger of injury from the use of insufficient lime would be as great as that from a slight excess. Hence, where fungous diseases in a greenhouse demand action, fumigation with HCN should precede the application of copper, or, if not, then only commercial basic copper carbonates, basic copper sulphates or non-staining ammoniacal copper sprays should be used.

244. WRIGHT, R. C., AND WHITEMAN, T. M. 635.64-2.111
Freezing of greenhouse-grown tomatoes in transit.
U.S. Dept. Agr. circ. 291, 1933, pp. 8.

The investigation described here was made in consequence of complaints by dealers of deterioration of greenhouse tomatoes due to freezing in transit. Tests showed that normal, firm ripe tomatoes could be stored for 48 hours at 50° F. (control) or at 24 hours at 30° F. followed by 24 hours at 50° F. without injury, but that storage for 24 hours at 17° F. followed by 24 hours at 50° F. resulted in nearly every case in injury. When specimens thus injured were cut open, the injured wall or outer fleshy rim and the partitions between the pulp receptacles had a water-soaked appearance which was darker than normal. The vascular strands, which appear on the cut surface as small light yellow dots, were found to be obliterated. The injured condition is shown in a coloured illustration.

245. GASSNER, G., AND HASSEBRAUK, K. 635.61-2.452
 Beiträge zur Kenntnis des Spargelrostes. (**A contribution on asparagus rust.**)
Gartenbauwissenschaft, 1934, 8 : 455-76, bibl. 32.

The life history of *Puccinia asparagi* DC is described and control measures are discussed. The only measure which has so far proved efficacious is the removal and burning of diseased foliage and heads in early autumn. German experience does not support the expediency of adopting the suggestion of Norton and Gilbert that turning under in spring is adequate protection. Other possible remedies including the breeding of resistant varieties have so far been unavailing. Copper sprays have in Germany as in America been found useless.

246. TAUBENHAUS, J. J., AND EZEKIEL, W. N. 635.25-2.8
Alkali scorch of Bermuda onions.
Amer. J. Bot., 1934, 21 : 69-71.

Brown stains on onions resembling burns were traced down to heavy alkali impregnation of the jute bags used for storage.

247. SMITH, A. M. 664.83
The storage of new potatoes.
Scottish J. Agr., 1934, 17 : 202-7, bibl. 5.

No great success has been achieved in the storage of tubers of early varieties, as they are very liable to sprout and the skin of certain varieties such as Epicure and Great Scot is apt to become dark and rough on storage. The first essential is the selection of a variety which has a suitable appearance, will not sprout too soon and yet approaches the "new potato" in cooking quality. The important factors in the actual storage are temperature, humidity, light and ventilation. Throughout the investigations described here the tubers were carefully packed in mixtures of approximately equal volumes of peat and sand containing different quantities of water. Trials took place in the laboratory, on a semi-commercial scale in pits in sandy soils, in seed boxes buried in sand and finally in ordinary fruit barrels of about 2 to 2½ cubic feet capacity, which were then stored in a cellar where the temperature fluctuated slightly round about 40° F. The barrels each held 40-50 lb. potatoes in 6 or 7 layers with a similar weight of packing interspersed. Such packing combined with a moisture content of 10 to 12 per cent. seemed to permit of adequate aeration and yet prevent a serious fall in the moisture content of the packing material

and was the most successful of the methods tried, producing potatoes of very attractive appearance. The time of entry into store of the barrelled potatoes was September 9th and of examination January 20th, the varieties used being Eclipse and King Edward.

FLOWER GROWING.

248. HUBBELL, D. S. 635.937.34 : 581.145
A morphological study of blind and flowering rose shoots, with special reference to flower bud differentiation.
J. Agr. Res., 1934, **48** : 91-5, bibl. 4.

The paper reports the result of studies on shoots of the Briarcliff variety. Each day in December and on the first four days in January 10 buds from flowering shoots and 10 buds from blind shoots were tagged. The mature stems were selected every time. The stems were cut back to the buds occupying the 4th axillary position, and these buds were collected and studied after reaching the desired age. It was found that the approximate date of flower bud differentiation on flowering shoots was from 8 to 10 days after active growth had started. Blind shoots were formed when the floral axis failed to develop a complete set of floral organs. Flower bud differentiation started about 2 days later in the blind shoots but at the end of 35 days the undeveloped flower had completely aborted. The author concludes that blindness is purely a physiological condition, in which an abortive bud is formed as the result of an improper balance of nutritional factors.

249. TUKEY, H. B., AND GREEN, E. L. 635.937.34-1.535
Gradient composition of rose shoots from tip to base.
Plant Physiol., 1934, **9** : 157-63, bibl. 4.

Shoots of *Rosa multiflora* 100 cm. in length, when cut into 10 cm. sections, showed a gradient of increasing moisture, ash, and total nitrogen content from base to tip and a gradient of decreasing starch content. The results of chemical determinations of rose shoots are presented and show great differences in the different parts of the stem, in view of which the authors suggest that "it would seem advisable to keep cuttings from a single shoot in numerical order, and to compare the rooting habit of the sequence of cuttings as a whole rather than make a percentage valuation as though it were a random sample."

The following also are noted :—

- ERLANSO, EILEEN W. **Chromosome pairing, structural hybridity and fragments in *Rosa*.** *Bot. Gazette*, 1933, **94** : 551-66, bibl. 18.
FOSTER, R. C., AND AVERY, G. S. **Parallelism of precipitation reactions and breeding results in the genus *Iris*.** *Bot. Gazette*, 1933, **94** : 714-28, bibl. 22.
LAURITZEN, J. I., AND OTHER. **Factors affecting gladiolus in storage.** *J. Agr. Res.*, 1934, **48** : 265-82, bibl. 5.
MAINS, E. B. **Host specialization in the rust of iris, *Puccinia Iridis*.** *Amer. J. Bot.*, 1934, **21** : 23-33, bibl. 5.

CITRUS AND SUB-TROPICAL FRUITS.*

250. WEST, E. S. 634.3
Citricultural research. Investigations at the Commonwealth Research Station, Griffith (N.S.W.).
J. Council Sci. and Indust. Res. Australia, 1933, **6** : 225-32.

When the Station was established in 1924 the management of the retentive soils of the Murrumbidgee Irrigation Area was causing great difficulty and many trees were dying through water-logging of the soil. Experiments in tile draining, deep ploughing, subsoiling and applications

* See also 168, 304.

of lime and gypsum were carried out but proved expensive. Subsequently cheaper and simpler methods proved successful. A high water table was found to be easily lowered by growing deep-rooted green crops between the citrus trees, while improved methods of irrigation prevented water-logging. In green manurial experiments it was found that trees under a winter green manure crop (tick beans) were larger and yielded 30 per cent. more than trees under a summer green manure (cow peas), a perennial green crop (lucerne), a biennial green manure (Bokkara clover) or continuous clean cultivation. The yield and size of the trees on the cowpea plots and on the lucerne plots are below those of the clean cultivated plots and indicate that the competition between the growing trees and summer green crops for water and perhaps minerals is too severe, and this in spite of the fact that three or four times the usual quantity of water was supplied to these plots. The fruit on the tick bean and clean plots coloured and lost its acidity earlier than that on the other plots. Several years of persistent growth and turning under of green manure crops has produced a soil structure definitely different from that of the clean cultivation plots. A different type of cracking occurs and water is readily absorbed, whereas on the clean plots the adequate absorption of the irrigation water becomes increasingly difficult. Other work in progress with green manures is the weekly investigation of the nitrate content of the soil of the tick bean and the clean plots, and further trials with other winter legumes either alone or in combination with tick bean. The mineral fertilizer experiments to ascertain the relative values of various treatments have, surprisingly in view of the early influence of the green manuring, given no significant results. During the experiments it was noticed that trees on all plots receiving superphosphates developed a mottling, regardless of whether or not nitrogen was added as well. Bud selection work indicates that much of the trouble experienced with young Navel trees is due to inferior types. Other investigations are concerned with irrigation. The overhead spray method is favoured as giving complete control and endeavours are being made to improve existing apparatus and to reduce the heavy initial cost of installation. Another investigation in hand is the alternate bearing of Valencia orange.

251. UPHOF, J. C. Th. 634.3 : 581.46
 Wissenschaftliche Beobachtungen und Versuche an Agrumen. VI. Einiges
 über die Blütenverhältnisse (1. Teil). (Notes and experiments on citrus
 varieties. VI. The flower. Part 1.)
 Gartenbauwissenschaft, 1934, 8 : 394-410, bibl. 16.

The author discusses at some length the morphological observations of earlier workers such as Ferrari, Commelijn, Sterbeeck, Rumphius, Riss and Poiteau, Bonavia, Engler. He then details important observations made by himself in his comparative study of citrus morphology in Florida. He compares differences in calyx, petals, corolla, stamens, pollen sacs, pollen, and receptacle, illustrating his points with drawings. He then discusses the matter of fertilization, cross-pollination and autogamy. In certain varieties such as the Satsuma mandarin autogamy would appear to be impossible owing to the position and formation of the various organs, in others such as the Temple mandarin autogamy is not only possible but frequent. In the Washington Navel and closely related trees fruit production is possible in the entire absence of pollination, a fact proved by emasculation and careful isolation experiments. As regards pollinations he describes two quite different methods by which the Italian bee *Apis mellifica* var. *ligustica* collects nectar. In one of them considerable disturbance is caused within the flower and pollination is thereby achieved, in the other the flower—in the case of the large flowered varieties only—is so little disturbed that pollination may not take place. In the smaller flowered varieties it is immaterial which method is adopted. Other insects important in pollination are *Bombus pennsylvanicus*, *B. impatiens*, *B. ternarius*, *Xylocopa virginica*, *Euephor bombiformis*, and flies and beetles in plenty. Examination of prematurely fallen flowers of Valencia Late and other oranges and of one or two grapefruit varieties showed that the pollen tubes had not penetrated more than half the required distance before ceasing to function. Yet in general it may be said that the existence of so many citrus hybrids is due to the normally great fertilizing capacity of fertile citrus pollen.

252. WELCH, J. H. 634.323 : 575.252

A new variety of grapefruit.

Hadar, 1934, 7 : 68-9, reprinted from *Texas Citriculture*.

A bud sport originating from a Marsh Pink grapefruit in a Texas orchard is described. The fruit is large and smooth-skinned with a crimson flush and the finely textured flesh is a rich ruby colour. The taste resembles that of Marsh Seedless. The plant has been patented. The sport has aroused the greatest interest since it is considered to be the most attractive variety of grapefruit yet developed.

253. QUINN, G. 634.3-1.541.11

A citrus rootstock trial.

Dept. Agr. South Australia bull. 279, 1933, pp. 210-14.

The establishment of a citrus rootstock trial at Adelaide is described. The stocks were grown from seed of the following varieties—sweet orange, sour orange, trifoliolate, rough lemon, grapefruit, Poorman orange, the latter being a local type whose botanical origin cannot be traced. In each case the seed was derived from one specially selected tree. Before budding all weaklings were eliminated and only plants of a uniform size were used. The scions used were Washington Navel, Valencia Late, Marsh grapefruit, Lisbon Improved lemon, Dancy tangerine, each selected from one tree of that particular kind. The budded trees were planted out in their permanent positions in 1931.

254. QUINN, G. 634.31-1.541.11 : 581.192

The influence of rootstocks on the texture and flavour of orange fruits.

Dept. Agr. South Australia, bull. 279, 1933, pp. 199-209, also issued separately as *bull.* 276.

The rootstocks used in this experiment at Berri were healthy well-grown seedlings of the various species utilized in the nursery. The budwood was from individual trees of observed habit of growth and fruiting. The varieties worked on sweet orange and rough lemon were planted out in 1913, 5 of each variety, those on Seville orange and pomelo stocks in 1915 again 5 of each variety, and the final lot (3 only of each variety) on trifoliolate orange were planted out in 1922. The soil is a coarse, reddish sandy pine ridge loam characteristic of the Murray valley. When the tests were made the fewest years of cropping, namely 7 years, stood to the credit of varieties on the trifoliolate. Twelve oranges of a determined size were gathered fortnightly from each tree and sent for analysis. The following data were established. The acidity in the fruits from Thompson's Navel trees on rough lemon was approximately 16·25% lower than that of fruits from trees on sweet orange. The acidity of Washington Navel was 12·08% less on rough lemon than on sweet orange. The percentages of sugar found in both cases was slightly greater on sweet orange stocks. As regards juice fruits of both varieties carried more juice when grown on sweet orange than on rough lemon. Fruits of both varieties became sweet to the palate earlier on rough lemon than on sweet orange. Tests with the Mediterranean Sweet variety yielded the following results:—acidity of fruits decreased progressively according to whether the rootstock was trifoliolate, sweet orange, pomelo or rough lemon respectively. Sweetness followed the same order. Juice was most abundant in fruits from pomelo stocks followed in turn by those on trifoliolate, sweet orange and rough lemon. Palate tests showed that some of the larger sized fruits on rough lemon only were mawkishly and insipidly sweet. Valencia Late. The order of acidity of Valencia fruits in descending order according to stock was trifoliolate sweet orange, pomelo, rough lemon: of sweetness—sweet orange, trifoliolate, rough lemon, pomelo: of juice—trifoliolate, rough lemon, sweet orange, pomelo. Insipidity was here again noticeable later in the season in the large fruits of trees on rough lemon. The data are tabulated.

255. ABBOTT, C. E. 634.3-1.547.4/5

Fruit bud development in some citrus trees.

Citrus Industry, 1934, 15 : 2 : 5, 20 and 25.

The differentiation of vegetative into fruit buds in grapefruit, sweet orange and Satsuma does not occur until the beginning of growth in the spring or upon the resumption of growth at any

other season of the year following a check of sufficient duration to allow for the accumulation of reserve food. The time of differentiation therefore varies from year to year with climatic variations, as is instanced by the occasional blossoming of citrus trees during a late summer when forced into growth following a prolonged drought. Similarly the prolonged check in winter is favourable to abundant blossom bud differentiation. This behaviour occurs in some other tropical plants, e.g. at the Hayti Coffee Experiment Station coffee buds mature during the dry season and the flowers open almost exactly eight days after the first rain subsequent to the winter dry season.

256. BATHURST, A. C. 634.3-1.8
Economies in citrus production.

South African Fruit Grower, 1934, 20 : 71-3 and 85-7.

The utility of fertilizers is discussed at length and it is decided that, applying the citrus fertilizer experiments of Riverside, California, to South African conditions, the only fertilizer that is absolutely necessary is some form of nitrogen applied preferably in organic form. South African soils usually contain enough of the other elements of plant growth to last for many years. The most economical and effective method of applying the fertilizer if in inorganic form is to make a concentrated solution and to add it in a small stream to the irrigation water. Irrigation is another source of waste. It has been shown that in many cases the water can be reduced with benefit to the trees by 20-50 per cent. Surplus water which penetrates below the root system of the tree never rises again and is lost. On the other hand water supplied in insufficient quantity to reach the roots quickly will also be rapidly lost by evaporation. The reduction of cultivation is advocated, provided sufficient is done to keep down weeds, since transpiration by plant life is responsible for the greater part of soil moisture loss.

257. SHAMEL, A. D., AND POMEROY, C. S. 634.31-1.542.24
Girdling Valencia orange trees.

California Citrograph, 1934, 19 : 176 and 186.

This study which covers the years 1931-3 bears out in its results the conclusions formed after an earlier study of Navel oranges grown under similar conditions (*Ibidem*, 1932, 18 : 38, *H.A.*, 1933, 3 : 1 : 87). In both cases larger yields were obtained from girdled than from ungirdled trees on the experimental plots. A decrease of yield followed the omission to girdle any tree which had been girdled the previous season, the decrease being equal to the increase due to the first girdling. No differences were apparent in size, grade or eating quality of fruit from girdled and ungirdled trees nor any differences in vegetation after two seasons of treatment. Growers wishing to girdle are advised to proceed experimentally with a few trees at first, as environment may have an important bearing on success. In this instance the girdling was done by means of a simple knife cut round the trunk, a strap buckled round the tree serving as a guide to the knife. [For description of a girdling tool see 258 of this issue.—ED.]

258. DENNIS, J. A. 634.31-1.542.24
Commercial girdling of navel orange trees.

California Citrograph, 1934, 19 : 177 and 191.

The author is the manager of the citrus orchards of the Edison Land and Water Company, Bakersfield, California. There are three methods of commercial girdling, the knife cut, the saw cut, and the cut made by special type tools. The knife cut is condemned for the following reasons. It makes a very narrow cut and is liable to penetrate too deeply, injuring the channels that carry the sap upwards from the roots and so creating a disturbance which may, if the practice is frequent, cause a gradual decline in tree condition and yield. The narrow cut does not give sufficient crop increase to warrant the risk. The saw cut is even less safe though it will give a larger increase in yield. A special type of tool is recommended which produces a V shaped cut $\frac{1}{8}$ inch wide at the surface narrowing to a point as it reaches the inner bark. The advantage of the wide saw cut is thus retained while the wide part of the tool prevents too deep an incision.

Marked and uniform increases without deterioration in normal vigour of foliage are claimed from the use of this tool. Reduced to essentials the tool, which can be made at home, is merely a rod $\frac{3}{8}$ inch in diameter, of soft steel for easy shaping, terminating in a forward-pointing hook. The extremity of this hook which penetrates the bark is slanted to a point and functions after the manner of a plough point, making a V shaped incision in the bark as it is drawn (not pushed) round the trunk. That part of the rod which is held in the hand can be shaped as most convenient for the user. The actual instrument is illustrated in the article. Girdling may increase yield materially in seasons of low production but not when yield is naturally high. The probabilities are gauged thus. If the bloom sheds quickly within a month, the yield will be good. If it lingers on the trees for more than a month or six weeks, girdling should be resorted to just after the petals have dropped. This early girdling is particularly necessary in orchards containing alkali in soil or irrigation water and in orchards where the soil is high in lime content or the irrigation water in bi-carbonates, since these materials are a factor in the formation of abscission layers in the nodes of the twigs immediately adjacent to the orange sets and have a considerable influence on increasing the "June drop". Some extra irrigation and manuring will be necessary with girdled trees.

259. ARNDT, F. R.

634.31-1.67

Orange survey on irrigation areas.

Dept. Agr. South Australia bull. 287, 1933, pp. 7.

A report of an investigation into the nature and condition of Washington Navel orange trees in the Berri Irrigation Area. An annual individual record was made just before harvest in May or June for the six consecutive years 1927-32 of 5,131 trees, situated in 7 typical orange groves. The features recorded were habit, condition of growth and its cause, quality and size of fruit, approximate crop in bushel cases. A number of off-type Navels were found in some orchards amounting to 13.89 per cent. of the total examined. The off-type is characterized by a more upright growth, sparser foliage, thicker skinned and rougher skinned fruit with a more acid flavour. These trees probably originated from the inadvertent propagation of bud mutations, though the Washington Navel was found on the whole to be a well defined stable variety. The chief environmental factors governing the condition of trees were the condition of the soil, injury due to washing of soil, culture, injury due to salt or seepage. Few trees of outstanding merit were found and in each case this superiority could be traced to particularly favourable environmental conditions. It was impossible to discover how much of their productiveness was due to hereditary factors transmittable by budding.

260. TRAUB, H. P.

634.31 : 581.192

Satsuma orange maturity and quality.

Gartenbauwissenschaft, 1934, 8 : 385-93, bibl. 12.

Preliminary data from Florida are presented for the season 1931-32 for the Owari and Kawano Wase varieties of Satsuma orange. Samples were taken at weekly intervals from the latter part of September till December. For each sample 1 fruit from each of 10 trees was collected and this always before 7 a.m. The author summarizes his tabulated and graphed results as follows: The fruit showed a tendency to flatness with increasing age; the average number of locules was 11, and the number of seeds less than 1 per fruit; specific gravity of the entire fruit decreased with age, and this decrease was correlated negatively with percentage of rind and positively with percentage of rag and juice; percentage of sugars was positively correlated with total solids of juice; total solids rose from 8% to 9% between the end of September and the middle of October, and from then on fluctuated between 9% and 10% to the end of November; the total acids of the juice declined with age; in general the ratio of solids to acids rose with age but similar ratios were indicated for various combinations of the terms, total solids and acids; the effective acidity decreased with age; in general rawness or immature taste disappeared by the beginning of October; no well defined trend for percentage of juice was observed for the period covered.

261. KNIGHT, H., AND JONES, P.

634.3-2.951.8

New developments in oil sprays.*California Citrograph*, 1934, 19 : 183 and 193.

A number of solutes have now been discovered with which it is for the first time possible to change the physical characteristics of light or heavy spray oils. By this means profound modifications may be effected in lessening the amount of oil deposited and the thickness of the resulting oil film and in increasing the spreading quality of the oil and the time of persistence without absorption of the oil film on the surface of the leaf. These solutes comprise the esters of the polyhydroxy alcohols and high molecular weight fatty acids and other similar substances. An ordinary light spray oil of 50 seconds viscosity applied to a citrus plant as tank mix at a concentration of 2% will have entirely disappeared from the leaf surface as free oil in 6 days. Treated with 2% of a suitable solute best adapted to prevent penetration of the leaf the time of persistence on the leaf surface is prolonged to over two months. The term emulsible oil is proposed for the oils containing these solutes, since they produce a true emulsion without the excessive agitation necessary to ensure a proper mix as with ordinary spray oils. These emulsible oils form a perfect vehicle for the introduction of oil soluble fungicides and oil soluble toxic materials, hitherto limited in amount and type because of emulsifier interference, and, on account of the increased persistence of the oil, such materials are kept longer on the trees and in contact with the insects. The oils are unaffected in storage by heat or cold and stocks can be carried over from year to year unimpaired, which is not always the case with emulsions.

262. NAUDE, T. J., AND ALLWRIGHT, W. J.

634.3-2.73

Control of citrus thrips. Experimental work at Mudén.*Farming in South Africa*, 1933, 90 : 337-8, 340.

The authors detail the data afforded by spraying and dusting trials in 1931-2 and 1932-3. Liquid lime sulphur was tested against dry lime sulphur and different brands of sulphur dust. The conclusion was reached that from a commercial point of view dusting appears to have certain definite advantages over spraying. It was found to be a quicker process and one which covered the trees more completely. On a basis of 1,000 trees to be treated the following were the costs for material only :—liquid lime sulphur at 4 gallons per tree and with spreader 2·16d. per tree, "Acme" dry lime sulphur at 3 lb. to 80 gallons of water at 4½ gallons per tree per application 2·2d. per tree, sulphur dust at 1½ lb. per tree 3·6d. per tree. Reckoning in labour costs, interest on capital investment in machinery, depreciation etc. it is thought there would be little difference in actual costs between dusting and spraying.

263. O'CONNOR, R.

634.3-1.5

An orchard sanitation experiment on citrus trees at River Estate, Trinidad.*Trop. Agriculture*, 1934, 11 : 100-101.

Noticing that some of the finest avocado pears and mangoes are grown in the concrete yards of Port of Spain the author has considered whether with necessary modifications the idea could not usefully be applied to grapefruit plantations, where every tree has a considerable value. The benefits hoped for were—the suppression of weeds, the prevention of waterlogging round the trees, the suppression or prevention of gummosis and root rot, the prevention of implemental damage, the suppression of ants' nests, the establishment of a generally better sanitary condition within the orchard. The principle was the construction of a circular layer of protective material over the surface of the soil surrounding the trees. In this experiment three types of layers were constructed. (1) A mixture of sand and cheap road oil. As much oil as the sand can absorb must be used (generally 3 parts sand to 1 oil), the ingredients being mixed together until a heavy plaster results. This is applied round the base of the tree and sloping gently from it, the radius being from 18 in. to 3 ft. and the thickness about 2 in. In two to three weeks when the layer is firm it is coated with "Colas", a United British Oilfields product. (2) "Secondary residuum", a product of Trinidad Leaseholds, a heavy viscous asphaltic oil when used alone, forms a heavy, matlike layer which clings closely to the ground and around the trunk, and effectually keeps down weeds. It needs no application of Colas, but will require to be slightly warmed before use.

It seems an excellent material for the purpose in view. (3) A mortar made of 4 parts fine clean sand to 1 part of well slaked lime. To the water used is added two large bottles of molasses which gives elasticity and prevents cracking. The mortar should be prepared about a week before using and left to set to prevent subsequent blistering. Three days after application, which is done as in (1), a coating of Colas is applied. The experiments were started in February 1933 and to date it can be said that during the dry season the oiled trees were fresher and better foliated than untreated ones, and that treated trees badly affected with gummosis are showing remarkable signs of recovery. Trees to be treated which are already affected with gummosis must have the diseased tissue cut away and the injured parts painted over with Colas. The cost in Trinidad including labour is about 15-18 cents per tree for the oil methods and 12-15 cents per tree for the mortar.

264. LAMBOURNE, J.

634.653

The avocado pear.

Malayan Agr. J., 1934, 22 : 131-40, bibl. 15.

The article deals with the culture of the avocado under Malayan conditions. In this abstract methods of propagation, being of more than local interest, are alone dealt with. Rootstocks are raised from seed, sown pointed end upwards in beds or boxes of sandy soil, transplanted when large enough to bamboo pots, kept in vigorous growth, and budded at 6-8 months, the stems being then of $\frac{1}{2}$ inch diameter. Two budding methods described (others are not precluded), are the well-known inverted T and the Forkert method. The Forkert method is a modified form of rectangular patch budding and is used with non-petioled ripe budwood. Two parallel incisions joined by another across the top are made, and the bark between is then stripped downwards, being held between the thumb and knife blade. Three-quarters of the resulting flap is then cut off. A piece of bark of the same size and shape as the stripped patch and containing the bud is then inserted and tied into place. A modified form of side grafting employed in Florida is described. Seedlings 5 to 6 inches long are dug up and laid on the bench. A cut 1 inch long is made in the shoot just above the seed and a thin section is removed. The scion consists of the tip of a small immature branchlet, is 1 inch long and contains two axillary and one terminal bud. The scion is tapered on one side to fit the cut on the stock and bound into place. The plant is then potted, placed under partial shade and kept well watered. After union has taken place the top of the seedling is removed and the scion allowed to grow. Cleft grafting is also used with young stocks. The scion should be a partially mature shoot greenish to light brown in colour and 4 to 5 inches long. In top grafting large trees the trunk is cut back with a saw to 3 feet from the ground. It is then opened by a preliminary saw cut of a few inches in depth, into which is driven a wedge of soft wood until splitting begins. The split edges are smoothed with a knife. Two mature scions are cut and tapered to fit the cleft one at each side of the trunk, the cambium of stock and scion being of course placed in contact. The wedge is then raised to allow the cleft to close on the scions sufficiently to hold them in place after which the wedge is cut off flush with the top of the stock. [In England a metal wedge would be used and removed after the scions had been inserted.—Ed.] The stock and scion are then covered with grafting wax. To prevent sun scorch the scion and the top of the stock are covered with a stout paper bag in which holes have been cut to admit air. Sometimes the paper collar is filled with sand enclosing the top of the stock and the scion, holes being left at the bottom for drainage. The paper coverings are maintained until the scion has grown large enough to provide shade.—Shoots from the stock are allowed to grow to maintain circulation of the sap until union is complete, when they are removed.

265. TRASK, E. E.

634.653-1.541.44

Avocado topworking.

California Avocado Assoc. Year Book, 1933, pp. 61-3.

Selection of bud and graft wood. Budwood should be taken from the vigorous tips of branches, using well matured buds from full, round wood. Graft scions should be taken from the older wood to be found between the first and second group of branches from the tip of a branch. Here will be found in some varieties well formed buds in the axils of the leaves, in others nodes of growth

carrying many small buds in the leaf scars. Material free from pests and disease will of course be used. It should be noted that the disease known as "sun blotch" can be transferred to the stock from infected scion wood. In nursery propagation T shield budding is used on seedling stocks of 6 months to 1 year. In topworking older trees the buds do not take so easily. The usual practice is to cut back the tree severely to force the production of shoots. These are budded a year later and thus the new top is built up. Grafting is a quicker method by which the new top will be fruiting in two years. The tree is cut back to the trunk with the exception of a leafy nurse branch left to maintain the roots which otherwise easily "drown". The most successful methods used are the cleft, side and bark graft, preferably the first. Each is described. Instead of grafting wax, which adheres imperfectly to the damp wood of the avocado, the use of an asphalt emulsion paint (such as Tree Seal and Tree Heal) is recommended. In California the graft scion is protected from sun scorch for the first three months by a paper bag and the trunk below the graft and the lower part of the nurse branch by a covering of burlap which remains till the new branches provide some shade.

266. KERN, E. 634.985.5
Sur la culture de chêne-liège en U.R.S.S. (**The cultivation of cork oak in Russia.**)
Rev. Bot. Appl., 1934, 14 : 13-16.

The attempts of Soviet Russia to establish plantations of cork oak in sufficient quantity to supply the nation's needs are described. Enough local seed not being available, recourse was had to the importation of seed from Tunis and elsewhere. In view of the cold of the mountain districts in which some of the new plantations were to be situated care was taken to obtain in addition seed from hardy mountain races abroad. Seeds from the trees of Transcaucasia and the Crimea are not suitable for cold districts being descendants of a Portuguese variety which does not grow above 1,800 ft. in its own land. The Spanish and North African varieties on the other hand are accustomed to higher altitudes and greater cold. Cold resistance is important in the early stages, since the protective cork layer does not form till the trees are 6 years old. Plants which attain that age have passed the danger point. The Morocco race is noted for its great height and its high grade cork, but the seeds are unobtainable since their export is forbidden. Where the climate is too favourable to growth as in Brazil and the Argentine the oak produces no cork. Since transplantation is difficult all seedlings have to be raised in pots and transplanted with ball of earth intact.

TROPICAL CROPS.*

267. GUEST, E. 633/635
Notes on plants and plant products with their colloquial names in 'Iraq.
Dept. Agr. 'Iraq, bull. 27, 1933, pp. 111.

The little that has already been published on the flora of 'Iraq is scattered over various botanical publications, not always easy of access. This bulletin has been produced with the object of providing a handy reference work for the use of students and other agricultural workers. The author states that in the time at his disposal it has not been possible to produce anything like a complete flora of the country but that the notes cover most of the principal wild and cultivated plants of 'Iraq as well as some of the imported plant products commonly found in local markets.

268. JONES, P. H. 633.681
Further notes on arrowroot.
Food, 1934, 3 : 225-6 and 228.

The adulteration of arrowroot is here discussed. No product should be described as arrowroot which does not consist entirely of the "separated and purified starch from the rhizomes of the plant known as *Maranta arundinacea*". This definition is that laid down by the St. Vincent Government.

* See also 208, 305, 306, 307, 311.

269. TUBBS, F. R. 633.72-1.542
Pruning in relation to estate profits.
Tea Quarterly, 1934, 7 : 4-10.

It is shown that tea growing at the highest elevations in Ceylon has over $2\frac{1}{2}$ times more carbohydrates in the roots than that growing at the lowest elevation, the fundamental cause of this difference being probably temperature. The practical result of this is that high elevation tea has ample reserves in its roots to enable it to recover from pruning while low country tea has not. Recent work confirms the opinion of Dr. Gadd expressed at the Tea Conference in 1929 that the death of tea plants after pruning was due to a deficiency of starch in the roots rather than to the fungus *Botryodiplodia Theobromae* which merely attacked plants already dying from physiological causes. It is argued that this loss of low country tea after clean pruning can be reduced to small proportions by the method of rim lung pruning, whereby branches are left on the outer edge of pruned trees to provide the tree with carbohydrates until it has recovered. Six lungs per tree bearing a total of 327 leaves decreased the number of deaths after pruning by 87 per cent., 22.5 deaths as against 168.6 per acre of 3,000 bushes, a difference which in times of non-restriction must have a considerable bearing on estate profits. Experiments still in progress indicate that pruning in such a way as to leave only 200 leaves per bush on the lungs has in under 2 years resulted in an increase of crop of over 200 lb. per acre besides reducing dieback and greatly improving the health of the trees.

270. EDEN, T. 631.459
Soil erosion III.
Tea Quarterly, 1933, 6 : 145-9.

In this article the three aspects of erosion dealt with are the nature of the crop, the effect of living ground cover, the effect of debris shed by the crop. [Previous articles of the series were abstracted in *H.A.*, 1933, 3 : 4 : 590.—ED.] It is shown that the commonly held idea that a good covering of tea will prevent erosion is fallacious, and that the only remedy is to fix the soil. Figures showing the liability to erosion of various crops are quoted and from these it is seen that all forms of cultivated crops, however closely planted, are liable to erosion. The efficacy of living ground cover is well known and needs no further discussion. The recent researches of Lowdermilk of the Forestry Research Station, California, and of workers in Czechoslovakia on the influence of forest litter (i.e. unhumidified vegetable remains) in preventing erosion are described. The forest litter is found to prevent erosion not so much by absorption as by keeping the soil beneath porous and so enhancing its natural capacity for percolation. In the absence of litter, minute clay particles are washed down into the soil pores and become a filter which greatly diminishes the percolation rate of the soil beneath. A 90 per cent. diminution in percolation in six hours was found during careful experiments. The fact that litter thus preserves the underground water supply in times of drought is also noted. Applying this discovery to modern tea culture it is suggested that the disuse of the *Grevillea* as planting cover in many districts is a matter for regret, since the use of this tree would do much to prevent erosion and to maintain the porosity and aeration of the land.

271. JOACHIM, A. W. R., AND KANDIAH, S. 631.874
The change in composition and decomposability of typical Ceylon green manures with age.
Trop. Agriculturist, 1934, 82 : 3-20, bibl. 12.

The investigations were confined to the commonly grown bush green manures, *Crotalaria anagyroides* and *Tephrosia candida* and the tree green manures, *Erythrina lithosperma* and *Gliricidia maculata*. Cover crops were not included, as the information was already available and the problem of the woody tissue does not arise with these crops. The object was to ascertain (1) the change occurring with age in chemical composition of typical tree and bush green manure loppings; (2) the relative amounts of green manure material obtainable at different periods of growth; (3) its decomposability by chemical methods; (4) the optimum time for cutting in order to obtain the maximum amount of easily decomposable plant material. The

methods of analysis are described. Results show with both bush and tree green manures, that the nitrogen, ash, lime, potash and phosphoric acid contents of all parts of the plant decrease, while the dry matter contents increase with age. The greatest falls occur with nitrogen (e.g. from 3.52% at 4 months to 0.96% at 8½ months in *Crotalaria*). The percentages of the constituents vary with environmental conditions but are always in descending order for both leaf and stem of nitrogen, potash, lime, phosphoric acid. The percentage nitrogen contents of the stem are $\frac{1}{3}$ – $\frac{1}{4}$ and the ash contents $\frac{1}{2}$ – $\frac{1}{3}$ that of the leaf. The ratio of leaf to stem falls rapidly with age (e.g. from 2.4 at 4 months to 0.3 at 8½ months in *Tephrosia* and 1.1 to 0.3 in *Erythrina*). Total amounts of nitrogen increase with age, being with the bush types at their maximum at time of flowering, 6–8 months. According to Waksman* a nitrogen content of 1.7% is just sufficient to cover the activities of plant decomposing bacteria over a period of 4 weeks: the excess nitrogen is rapidly liberated in available form. Thus here it appears that the latest time for rapid decomposition in the soils are the 6th and 8th months respectively for *Crotalaria* and *Tephrosia* (time of flowering) and the 6th and 5th months respectively for *Erythrina* and *Gliricidia* entire branches. Practically applied, the maximum benefit will be derived from cutting bush green manures at flowering time and lopping tree crops, taking into consideration such factors as leaf shedding and the ill effects of too frequent loppings as shown in reduced nitrogen and organic matter, every 4–5 months.

272. IMPERIAL INSTITUTE.

633.73

The development of coffee production in the Empire.

Bulletin Imperial Institute, 1933, 31 : 507–34, bibl. 85.

There is in the world a demand for two principal grades of coffee: a very large demand for cheap coffee of the Brazilian type and a small demand for the high grade, expensive, mild coffees such as are produced by Colombia. The lines on which the various coffee-growing countries of the Empire are proceeding are indicated in a short resumé of the situation in each. An historical note of the beginnings of the industry and an account of the present cultural conditions peculiar to each country are given. There is a bibliography of 85 publications on coffee, classified according to country. Reports of Departments of Agriculture which the author states are often the main source of information provided mostly in the form of scattered notes are not included in the bibliography.

273. CHEESMAN, E. E.

633.74–1.532/5

The vegetative propagation of cacao.

Empire J. Exp. Agr., 1934, 2 : 40–50, bibl. 14.

The history of the normal vegetative propagation of cacao by budding and grafting is briefly summarized. There is, however, every reason to think that uniformity of rootstock, as with deciduous fruits, is as necessary as uniformity of scion. For this reason in the absence of clonal rootstocks, when the Cacao Research Scheme was launched at the Imperial College of Tropical Agriculture, Trinidad, in 1930, it was decided to concentrate on the vegetative reproduction of cacao on its own roots. The methods by which this has been accomplished by means of cuttings and layers are described. Technique has been perfected to the point that the isolation of any desired clone on its own roots is now a matter of routine and it remains to decide which of the several methods available will prove the most advantageous for use on a commercial scale. This raises three questions of the greatest importance. (1) Should the root system be of seedling or of vegetative origin? (2) Should the root system and scion be of different genotype or identical? (3) Should the scion or fan be of chupon as opposed to branch origin? (1) Root systems. The argument of the economic disadvantages of heterozygous seedling rootstocks in the case of deciduous fruits can at present, in the absence of records and clonal stock, only be applied to cacao by analogy, but the little evidence available does not contradict the hypothesis. Against this must be set the strong prejudice in the tropics against trees on non-seedling root systems held mainly on account of supposed insecurity of root hold. The shallow rooting

* Waksman and Tenny. Composition of natural organic materials and their decomposition in the soil. *Soil Sci.* 24 : 3.

habit of cacao raised from fan branches as opposed to the deep rooting systems of chupon-raised cuttings or layers leads the author to consider that in the former instance the objection may be valid. Decisive information on the point will take some years to obtain. Meanwhile for the purposes of other investigations the answer will be presumed to be favourable to clonal stocks. (2) Composition of tree. Cacao is selected for yield, whereas deciduous fruits are primarily selected for qualitative characters. If a high yielding cacao tree, which must necessarily be in possession of a root system capable of supporting that yield, can produce a similar root system from cuttings or layers the main object of vegetative propagation will have been obtained. A further argument in favour of trees on their own roots lies in the regenerative habit of cacao by which badly cankered trees can be entirely renewed by allowing a basal chupon to grow, ultimately to take the place of the main trunk. This common estate practice could not be carried out with budded cacao since the basal chupon would then be of the stock variety. Nevertheless the possible uses of stocks to change the habits of the scion are not to be forgotten. (3) Branch-systems. Cacao vegetatively propagated from fan branches will assume a low branching form with no main trunk, but if propagated from chupons it will produce a high branching form arising from a main trunk. In deciding between the two the difference in the two root systems may prove the deciding factor, otherwise there seem to be no other botanical considerations. In conclusion it remains to be ascertained whether Harland's pronouncement, made after the study of yield records of budded trees, that there is no certainty that a parent tree will transmit its high yielding capacity to its budded offspring, applies also when the propagation is done by cuttings and layers. If it does, it may affect the whole future of vegetatively propagated cacao.

274. FREISE, F. W. 633.85
Der brasilianische Iguape-Nusbaum. (*The Brazilian candleberry tree* [*Aleu-rites moluccana* (L.) Willd.].)
Tropenpflanzer, 1934, 37 : 59-64, bibl. 4.

A full account is given of the characteristics of the growth of this tree and of its fruits, which provide an oil from which soap is made. Attempts to propagate it on a larger scale have been desultory and somewhat ineffective. The author gives details of cultivation and of processing to obtain the oil with notes on the physical and chemical composition of the oil and its reaction to heat. It is quite unsuitable for cooking, containing as it does an active and poisonous alkaloid of unknown structure. Tests are now in progress on its suitability as a source of colour for printing ink, of grease for aeroplane motors, and of preparations for the treatment of skin diseases of the herpes type.

275. DE MOL, G. A. 633.879
Gambircultuur en gambirbereiding in de onderafdeelingen sekadau en sintang van West-Borneo. (*Cultivation and manufacture of gambier in West Borneo.*)
[Dutch-English summary.]
Landbouw, 1934, 9 : 336-70.

Manufactured gambier is an astringent extract of *Uncaria gambir* (*Rubiaceae*), used in tanning. The cultivation is simple, but harvesting and subsequent manufacture under native conditions are processes requiring great skill and experience. The methods employed are fully described in the article but by reason of their complicated nature do not lend themselves to compression within the limits of a short abstract.

276. KAUSCHE, G. A. 633.912-1.541.5
Über Wachstums- und Verwachsungserscheinungen an Oculationen von *Hevea brasiliensis*. (*Growth and callus phenomena observable at the budding of rubber.*)
Gartenbauwissenschaft, 1934, 8 : 411-50, bibl. 61.

The author summarizes the results of his examination of the area of union of budded rubber as follows:—(1) The union of stock and scion in hevea is characterized by the appearance of callus zones, which vary from one another in their anatomical structure. (2) The zone of surface

callusing forms a callus plerome which is neither absorbed nor replaced. Mechanical strengthening takes place during development as the result of callus cell walls becoming woody. (3) The wound surface of the union is marked by the formation of border zones consisting of deformed cells and broken down membranes, which are not reabsorbed or displaced during the process of union. (4) New cambium formation starts at the circumference from the original cambium in the bud. Hence run out the cambium bridges of the upper, lower and lateral zones of union. (5) In contrast to the surface zone it is found that in the lateral, upper and lower zones of the wound cleft wound callus is formed immediately, and in this meristematic zones arise which give off wood elements on the interior and bark elements on the exterior. The first formed wound callus on the surface of the stock is differentiated into wound wood. (6) In the callus tissues of the upper, lower and lateral zones latex bundles soon appear, usually without there being any connection between them and those in the bud or stock. Close to them arise latex "cells" similar to those found in embryonal tissues of hevea. (7) The rubber found in all the callus zones other than in the latex bundles in hevea budding arrives at these spots as the result of the wounding of the latex vessels. The question of its appearance in the tracheae remains undecided. (8) The tracheae behind the zone of surface callusing are often filled with tylose. This takes no part in callus formation. (9) The completion of union takes place very quickly. Callus formation begins after 24-36 hours, stock and scion being about equally concerned. Seven days after budding the cavity is loosely covered in. On the 9th day the callus of the stock begins to become woody. The callus which fills the cavity has become woody by the 16th or 17th day and its mechanical strengthening is complete. About 8 days after budding we find the first xylem elements being formed in the former bud cambium. On the 13th day the tissue formed from the bud cambium begins to get woody and the process is complete 3 days afterwards. (10) The analogous processes in the wound cleft are at the same time running a similar course. (11) The trials were made on some 15 combinations of stock and scion, so that it was possible to test whether particular clones showed typical callus formation. They show that the principle of union is the same in all clones. Where abnormal structures are found they are due to local contingencies. (12) Within a clone every type of deviation from normal callusing may be seen. (13) The time taken for the completion of the budding operation depends on the degree of union achieved and on the structure of the callus zone. (14) The continual formation of the water conducting bundles and of the cambium inside the callus zones is decisive for the degree of callusing. (15) The decapitation of the stock and the subsequent growth of the bud give rise to processes which are instrumental in producing the point of union ("Verwachsungsstelle") and the so-called "elephant foot". (16) The place of union is identified with the ring formed by the displaced bud and not with the place where both stock and scion have coalesced. (17) The processes involved in the thickening of the stock have not been fully cleared up, though the factors concerned have been determined.

277. BELLIER, —. 634.1/7
 Arbres fruitiers exotiques acclimatés du Maroc. (**Exotic fruit trees acclimatized in Morocco.**)
Congrès international d'arboriculture fruitière et de pomologie, Morocco, 1934, pp. 3-9.

The fruits dealt with in the paper are those to which the climate and conditions of Morocco have proved definitely acceptable. These are guava, feidjoa, pistache, pecan, avocado, custard apple, soursop, cherimoya, and loquat. Notes are given on local methods of cultivation and propagation.

278. LEVIE, E. L. 634.1/8 : 382.6
 De exportmogelijkheden van Hollandsch fruit naar Nederl. Indië en van Indisch fruit naar Holland. (**The possibility of exporting Dutch fruit to the Dutch East Indies and East Indian fruit to Holland.**)
Landbouwkundig Tijdschrift, 1933, 45 : 591-594.

Hitherto Holland has imported but little fruit into her colonies. The writer gives two reasons for this:—(1) The fruit is too expensive in the colonies. (2) Exporters in Holland are not yet

fully experienced in the export of fruit over very long distances. For export from Holland to the East Indies two kinds of fruit may be considered suitable, apples and grapes. In the writer's opinion the export of grapes rather than of apples should be encouraged on economic grounds. The problem of exporting fruit from the East Indies into Holland is made difficult by the abundance of good fruit in Holland. The writer is of the opinion that bananas and pineapples should have the best chance, though here also the small profits do not make prospects very inviting for dealers in the East Indies. V.d.L.

279. LAMBOURNE, J. 634.1/7-1.534.4

The propagation of fruit trees.

Malayan Agr. J., 1934, 22 : 58-62, bibl. 2.

A report on the results so far obtained in the vegetative propagation of tropical fruit trees by the etiolation method in Malaya. The author states that the method followed, with certain modifications due to tropical conditions, is that employed at East Malling for the rapid reproduction of clonal rootstocks of deciduous fruits. The object in Malaya, however, is not to obtain rootstocks but to find a more rapid and wholesale method than the commonly used marcottage of obtaining vegetatively propagated plants on their own roots. It is, however, necessary to start with marcots obtained from the tree which it is desired to propagate. These are planted in a single row in trenches which have been filled with a good rooting medium of well cultivated soil and farmyard manure. The dimensions of the trench before refilling are 2½ ft. deep by 2 ft. wide. The rooted marcots are set obliquely in the trench at an angle of 35° with the horizontal, and when established are pegged down in a shallow trench about an inch below the level of the bed. Young shoots will appear along the stems and lateral branches. When 4-6 inches high these shoots are covered at the bases with 2-3 inches of sandy soil which is increased to 5 inches as the shoots grow. Some varieties will now produce roots from the etiolated portion without further encouragement, but in other varieties it is necessary to twist a wire round the base of each shoot where it arises from the main stem [Oppenheim, J. E., *Hadar*, 1932, 5 : 2-4, abstracted *H.A.*, 1932, 2 : 2 : 162, describing a somewhat similar method for citrus, says that the wire when first put on must not be tight enough to injure the bark. Subsequently as the shoot swells it will penetrate the bark.—ED.]. When the plants are rooted they are cut from the parent, potted and kept under dense shade in moist conditions till, after a gradual hardening, they are ready for planting in the field. A mistake made in the early experiments was to cover the buds with soil before they began to grow. This is the practice at East Malling with deciduous trees but it proved fatal to the evergreen trees of the tropics. Trees that have rooted by these methods without wire are lime and citron. *Nephelium lappaceum* (rambutan), *N. mutabile* (pulasan), *Eugenia* spp., *Persea gratissima* (avocado pear), *Achras Zapota*, *Citrus Aurantium* (orange) require the aid of wire.

280. BAL, A. J. 634.57

De tengkawang in de westerafdeeling van Borneo. (Illipe nuts in West

Borneo.) [Dutch-English summary.]

Landbouw, 1933, 9 : 211-78.

The seeds of at least 7 species of *Shorea* known to commerce under the collective name illipe nuts and under the native name tengkawang form an important produce of West Borneo. The principal markets are Great Britain, France and Singapore. The value of the nuts lies in the fat, which having the high melting point of 35° C. is especially useful in the manufacture of chocolate confectionery, cosmetics, margarine, candles, soap and in medicine. There are four commercial qualities of illipe nuts, Large Black, Small Black, Large Brown, Small Brown, valued in the above order. Two methods of preparation are used, the wet method whereby fruits are soaked in running water and then sun-dried, and the dry method by which the fruits are kiln-dried. The wet method produces a black product of good consistency, while the dry method produces a brown product which has the disadvantage of susceptibility to borer attack. The seeds are collected both from wild trees and from others which are cultivated in a more or less primitive fashion.

281. STOFFELS, E. 634.6
 Contribution à l'étude de la selection de l'*Elaeis guineensis* à Sumatra. (Oil palm selection in Sumatra.)
Rev. Bot. Appl., 1934, 14 : 93-101.

Fertilization of the female flowers should take place within three days of the extrusion of the stigma. After that period the stigma reddens and fertilization will not succeed. The male flowers open a month earlier than the female flowers on the same tree, but the enormous quantity of pollen produced ensures regular fertilization from neighbouring trees. The vitality of the pollen is such, however, that self fertilization often occurs. Pollen may be preserved in viable condition for over a year if carefully dried. The plantations of Sumatra consist mainly of the variety *dura*=type Deli, the offspring of 3 trees introduced from the island of Bourbon in 1848. Seeds of supposed high yielding varieties have been imported in large quantities on several occasions, but the resulting plants have always, with very few exceptions, proved inferior to the established variety and have generally been discarded. Various commercially grown varieties of *Elaeis guineensis* are described. The variety *dura* itself appears to be composed of certain sub-types which differ in their yield. These are recognized by the colour of the petiole and it is an accepted fact that palms having the base of the petiole brown are inferior in yield to those having a green or yellow base, and it is further remarked that as between green and yellow bases, all the recognized highest yielders in the country have the base of the petiole green. In discussing the ecological factors of importance to the oil palm the following points are brought out. The most favourable climate is one which is warm and dry when the palms are in flower and hot and rainy during the ripening period ; light is important as is evidenced by the fact that the palms on the outsides of the plantations and on the plantation roadways bear more heavily than those in the interior ; hot dry winds are harmless and help to distribute the pollen ; a well drained soil is important, and the volcanic soils of Sumatra are particularly suitable ; a plot having a cover crop of the legume *Pueraria javanica* gave double the yield of a similar plot which had been invaded by a native grass. It is suggested that by the self fertilization of high yielders for several generations a very prolific strain could be built up.

282. MILSUM, J. N. 634.6
 The oil palm in Sumatra.
Malayan Agr. J., 1934, 22 : 29-33.

Seeds are sown in sand beds in damp situations preferably in full sunlight, this latter condition producing a higher germination. Germination is 80% within 5 or 6 months of sowing. If the seed is soaked for 2 days in 1% solution of hydrochloric acid and rinsed in running water for a further 2 days, the rate of germination is much increased. Great importance is attached in Sumatra to using only seed of known parentage. Pedigree seeds are always procurable by planters from the A.V.R.O.S. General Experiment Station, and the attention paid to this matter is well justified by results. The palms are transplanted to sheltered nursery beds when they have made two leaves and are planted in the field when a year old, spacing being 9 metres by 9 metres triangular on the flat or 9 metres by 6 metres on contoured hillsides. An effective green manuring system is in use. Four rows of *Leucaena glauca* are sown between the young palms, cut back to 2 feet from ground level at 9-12 months and subsequently slashed every 6 months. *Centrosema pubescens* and *Pueraria javanica* are sown between the *Leucaena* rows and gradually smother it out, the debris forming a surface layer of humus. A cover crop of increasing popularity for low-lying fields is *Momordica Charantia* [Cucurbitaceae.—Ed.]. It makes rapid, even growth and entirely smothers all weeds. A space of 5 feet radius is left clear round each tree, the spaces being eventually connected up to allow free passage in harvesting. The cover crops are regularly manured. Hand weeding is practised as producing the least disturbance of the soil and therefore the least erosion. The first pruning is done just prior to the first harvest when the trees are four years old. The trees are cleaned to allow easy access to the fruit bunches. Removal of the lower leaves is considered to assist natural pollination. Subsequent pruning consists of an annual clean up once a year. Artificial pollination is often practised. Fresh pollen is absolutely

essential to success. The palms are patrolled every four days, one pollinating labourer being required for every 170 acres of bearing palms. An iron L-shaped hook is used to open the fibrous sheath enclosing the female inflorescence. Manuring usually consists of an annual application of Cheribon rock phosphate at the rate of 4.4 lb. (2 kilos) per palm or 242 lb. per acre. It is broadcast on the cover crops and washed into the soil by rain, a method reported to be both satisfactory and economical. In manurial experiments rock phosphates have shown an immediate crop increase of over 60%. Little response was shown to nitrogen and potash. Harvesting is carefully organized, light railways running from factory to fields to convey the bunches. Payment is by results in addition to a minimum wage, the average daily crop harvested per man being 1,760 lb.

283. MYSORE AGRICULTURAL DEPARTMENT.
Coconut cultivation on the Barbur Farm.
Mysore Agr. Calendar, 1934, pp. 50-52.

634.61

The article gives the average yields since 1928, when they first came into bearing, of a large number of coconut palms raised from seed collected from various villages in the State. The point brought out by these figures is the wide range of performance among seedling trees of identical age grown under similar conditions but of different parentage. Sample 3-year averages for high and low yielding groups under similar manurial treatments are—high 124.4 nuts per tree, low 23.0; high 77.2, low 4.0; high 128, low 12. Individual trees bore up to 300 nuts in certain years. A plantain crop was laid down in 1922 on the same plot the year previous to planting the coconuts, and was maintained till 1926. It is considered that thus the profits from the plantains nearly pay for the expenses of bringing the palms to bearing age, that attacks of the black beetle are reduced and that shade and a moist atmosphere are provided for the young coconut plants.

284. PIERIS, W. V. D.
Studies on the coconut palm. I.
Trop. Agriculturist, 1934, 82: 75-97, bibl. 7.

634.61

The need for the improvement of the coconut palm from the point of view of yield is briefly discussed. There is great variation in the characters of the palm and these have recently been studied under the Coconut Research Scheme of Ceylon in order to arrive at a standard on which the selection of mother trees may be based. 1. *Length of frond*. Short fronded varieties are to be preferred because the fronds are better oriented on the tree and provide a more efficient support to the bunches immediately above them. 2. *Length of petiole*. For the same reasons a short petiole is desirable. Length of frond and length of petiole are positively correlated. 3. *Width of petiole*. A wide petiole is desirable for the same reasons as 1 and 2, but unfortunately width is positively and not negatively correlated with length. 4. *Length of inflorescence and inflorescence stalk*. This is a very variable character. Short bunch stalks are desirable because they do not require propping nor does the short stalk kink with the weight of nuts. Kinking of the bunch stalk always results in a premature nut fall. There is a positive correlation between shortness of petiole and shortness of inflorescence. Both are regarded as characters of the greatest importance. 5. *Number of branchlets on inflorescence*. There is a weak positive correlation (0.35 ± 0.057) between length of inflorescence and number of branchlets. 6. *Number of female flowers on the inflorescence*. An extremely variable character ranging from nil to over 300. Counts on 215 inflorescences showed a range of variation from 1-92 female flowers. The frequency distribution is very asymmetrical and 90% of the observations lie between 0 and 44. The correlation between the number of branchlets on the inflorescence and the number of female flowers is almost nil, so that there is little danger that by the selection of short inflorescences bearing fewer branchlets the number of female flowers will be reduced. 7. *Number of ripe kernels*. There is a small positive correlation (0.64 ± 0.038) between the number of female flowers and the number of ripe nuts. This was fairly close up to 50 female flowers,

but for larger numbers of female flowers the number of nuts was not always correspondingly high. In actual selection on a basis of high yield it is desirable that in addition to the crop on the lower branches the upper branches should be well furnished with fertilized flowers (i.e. immature nuts of various sizes) and that the bunches should be evenly set round the crown in a complete ring without gaps. The final basis of selection should be on the weight of kernels produced by the palm during the year. Contrary to the general idea there is a high positive correlation (0.91) between the number of nuts produced per palm and the weight of copra. Thus the number of nuts produced may be safely used as one standard in selection. 8. *Weight of nuts unhusked and husked.* There is a very close correlation between the weight of unhusked nuts (heaped for a month in the open in accordance with estate practice) and weight of copra, and also between the weight of husked nuts and the weight of copra (0.96 ± 0.005). Thus the three characters, number of nuts, weight of husked nuts and weight of unhusked nuts, provide a rapid and safe means of selection for yield and for ascertaining results in other experimental work, without the necessity of converting the nuts into copra, a process liable to error particularly over a period of years. The weight of the husked nuts is the most reliable of the three. 9. *Age of selection.* No scientific evidence is available. Until it is, the traditional age for seed selection of between 20 and 50 years is advocated. The relations outlined in this paper are supported by 10 correlation tables.

285. VEITCH, R.

634.771/3-2.73

Banana thrips control.

Queensland Agr. J., 1934, **41** : 124-7.

The banana thrips, *Scirtothrips signipennis* Bagnall, is the second most important pest of bananas in Queensland. The banana weevil borer *Cosmopolites sordida* Chev. takes first place in point of distribution, but a severe attack of thrips with its associated "rust" injury may ruin the whole cut of fruit on a plantation. The insect and its life history are described. Control measures consist of a weekly application of nicotine dust, the nicotine being present either as free nicotine or nicotine sulphate, distributed by means of a rotary duster or a hand dust gun. The dose should not be excessive or unsightly deposits will accumulate on the fruit. It is not suggested that these control measures should be taken unless the infestation shows signs of becoming severe.

286. SIMMONDS, J. H.

634.771/3-2.8

Bunchy top disease of the banana and its control.

Queensland Agr. J., 1934, **41** : 241-4.

Bunchy top of banana is a virus disease, the vector being the banana aphid. The name bunchy top is a sufficient description of the appearance of the foliage in the advanced stages of the disease, but control measures should be taken long before this obvious condition is reached. The onset of the disease can be recognized by the lighter green colour along the edge of the youngest leaves and by the fact that the blades dip back from the midrib and curve in again conspicuously from the margin. A photograph accompanying the article shows this condition admirably. Further inspection of the underside of the base of the youngest leaf, held so that the light is behind it, will reveal, if infection is present, short, broken or continuous lines of a dark green colour lying between and parallel to the clear veins which run at right angles to the midrib. Often one or more wider dark green streaks are visible running down the outside of the leaf stalk near its junction with the pseudostem. Control measures consist in planting only disease-free material and by immediate eradication of the infected stool and all suckers connected with it. Half a pint of paraffin is poured into the central leaf of the affected plant and allowed to trickle round the leaf bases in order to destroy all aphids. A few hours later the plant is dug up and chopped into pieces to facilitate drying [and presumably burnt.—Ed.].

287. CLAES, F. 635.13
The arrachacha.
Gardeners' Chronicle, 1934, 95 : 2467 : 236.

It is suggested that the arrachacha or Peruvian carrot (*Arrachacha esculenta* ord. *Umbelliferae*) is a vegetable whose cultivation might well be extended to those warmer countries where an addition to the table vegetables available would be welcome. The rich fleshy roots which are the parts eaten have a similar food value to potatoes and manioc and form an excellent accompaniment to roast meats. It is cultivated in Peru at an altitude of 4,000-6,000 ft. in light, well manured soil. It is always propagated by division of the crown, seed bearing plants being rare.

STORAGE.*

288. KIDD, F., AND WEST, C. 664.85.11.035.1
Gas storage of apples.
Report Food Investigation Bd. for 1932, 1933, pp. 207-9.

Results emphasize the remarkable difference in behaviour of different varieties in various atmospheres and show that careful, controlled investigation into the best combination of temperature and atmosphere is essential before submitting any variety to such storage. Fruits of Lane's Prince Albert, Annie Elizabeth, Cox's Orange Pippin and Ellison's Orange apples were submitted in ten artificial atmospheres to each of three temperatures, namely 1° C., 4° C. and 10° C. for 9 months, the atmospheres being 5, 10 and 15% CO₂ with 2.5, 5 and 10% O₂ respectively, while as a control 21% O₂ without CO₂ was used. In each case the remaining percentage was made up of N. Wrappers impregnated with odourless mineral oil were used. Only in the case of Lane's Prince Albert was complete success achieved and apples produced from store equivalent to normal unripe fruit. The conditions were 39.2° F. (4° C.), with an atmosphere of 2.5 (or 5)% O₂ and 5% CO₂. Other results are discussed and their indications noted.

289. ONSLOW, M., AND OTHERS. 664.85.11 : 631.542.24
Biochemical study of senescence in apples.
Rept. Food Investigation Bd. for 1932, 1933, pp. 70-75, bibl. 3.

The progress of chemical changes during storage of Bramley's Seedling apples from ringed and comparable, unringed trees is detailed. The fruits from the ringed trees were found to have the higher respiratory activity throughout and a shorter life in store. Differences in composition are noted. The evidence forthcoming supports the theory that breakdown may be due primarily to excess of oxygen. It is noted that excess of oxygen, if given early in the storage life does actually produce symptoms in every way similar to low temperature breakdown.

290. KIDD, F., AND WEST, C. 664.85.11 : 632.19
The control of superficial scald of apples.
Rept. Food Investigation Bd. for 1932, 1933, pp. 58-62.

Comparing the storage of Newton Wonder apples enveloped in oil wrappers containing varying quantities of oil and of different absorbent power with apples coated with the same amount of oil as was contained in the wrappers and with unwrapped apples, the authors found that the mere coating with oil was practically useless, and that wrappers containing 15% oil had effected a considerable measure of success, the scald at the end of 147 days being only 6% and the intensity 10% as against 85% and 40% in the case of controls. The lighter, less absorbent paper was found to be more effective than the heavier paper, the difference being apparently more noticeable when there is little oil present. Of the oils used viz. (a) half white no. 2, (b) crystal oil no. 11, and (c) crystal oil no. 3, (c) was possibly less efficient than (a) or (b), while (a) imparted a bad flavour.

* See also 244, 247, 312.

291. ROSE, D. H., AND LUTZ, J. M. 664.85.11 : 632.1
Bruising and freezing of apples in storage and transit.
U.S. Dept. Agr. tech. bull. 370, 1933, pp. 14, bibl. 12.

In this bulletin are recorded results of investigations into a particular type of injury found most commonly at the bottom of loads of boxed apples after transport by rail. It was found possible to produce the injury both at freezing and non-freezing temperatures by jolting apples in commercially packed boxes with and without pressure from the outside. Trials also showed that lining the insides of the boxes with corrugated paper eliminated nearly all the injury both under laboratory conditions and in actual practice. Wooden strips under the ends were not found to be of any use. Moreover in barrels the insertion of a corrugated paper pad on the top of the fruit after filling and before heading up also seemed to be useless. Under laboratory tests inserting a layer of cork, lith or Celotex beneath the bottom layer in boxes was also tried in vain. [From authors' summary.]

292. BRIEN, R. M. 664.85.11 : 632.4
The fungi causing rots of stored apples in New Zealand.
New Zealand J. Agr., 1934, 48 : 143-9, bibl. 5.

Fifteen fungi were identified. Ten were common and are discussed individually in the paper. The remaining five were not sufficiently frequent to be of economic significance. A summary of the various points of entry on 1,035 fruits gave the following percentages—skin punctures 39.2, skin injuries 15.6, calyx entry 11.5, stem end entry 18.3, insect punctures 11.7, russet 2.2, lenticel entry 1.5.

293. KIDD, F., AND WEST, C. 664.84.65.035.1
Gas storage of tomatoes.
Report Food Investigation Bd. for 1932, 1933, pp. 209-12.

Tomatoes were of the "Potentate" type and were gathered at two stages of maturity, i.e. "yellow" and "tinted". Large comparable samples were stored in air at 18° C., 15° C., 12° C., 8.5° C. and 5° C. and in artificial atmospheres 2.5, 5 and 10% O₂ with 0, 5 and 10% CO₂ respectively at three temperatures, 15° C., 12° C. and 8.5° C. The remainder of the atmosphere was in each case made up of N. Results are discussed and lead to the following final note:—"At each temperature some form of gas storage is better than storage in air. The best artificial atmosphere however, varies with temperature. It would appear that the intermediate temperature 12° C. is the best in air and that the best of all conditions of storage are 5% O₂ with 5% CO₂ at this temperature. Higher percentages of CO₂ have an injurious effect and this effect, as in the case of apples, is more pronounced the lower the temperature."

294. CARRIÈRE, E., AND BOSC, M. 664.85.8
Conservation des raisins par l'anhydride sulfureux. (Sulphur dioxide for preserving grapes.)
Prog. agr. et. vit., 1934, 101 : 257-9.

The aim being to slow down the shrinkage of grapes due to loss of water it is found necessary not only to ensure a moist atmosphere, but also to prevent the growth of moulds thus encouraged, by a slow, continuous production of sulphur anhydride. A problem which arises here and which is being examined now is the amount of sodium bisulphite necessary to keep the grapes free from moulds while not imparting to them an evil taste. The variety used in the experiment was the Servant variety, the bunches of which were not specially selected, being picked in October and examined finally at the end of January. The trial showed that average sized bunches kept the best. First the bunches were suspended on wires in a room containing the cupboards to be used for storing. Sulphur anhydride was then sprayed to kill any mould germs present, care being taken not to direct the spray on to the grapes. The bunches remained in this atmosphere for some 48 hours, after which the room was aired for 5 hours. Careful observations were made during the subsequent 7 or 8 days and any grapes showing signs of mould were removed. [This is said to be essential.—ED.] The cupboards had shelves and hooks on which to hang the

bunches and were carefully brushed with bisulphite solution before use. The solution was commercial sodium bisulphite, titrated 35° Baumé at ordinary temperatures, diluted with 5 litres of water. One litre of this was then put in porcelain bowls and 2 bowls were set in each of the lower shelves of 2 of the 3 cupboards. A fortnight afterwards the two bowls were reduced to one in each case and in one of these two cupboards a bowl of water was placed in the top shelf. Results were tested several months later. The cupboard containing the solution + the bowl of water had been most successful in its task, the grapes being in excellent condition with loss of moisture only 16%. In the cupboard containing the solution but no water, results were not quite so good, loss of water being 22%, while in the control cupboard loss of water was 27% and the grapes were in poor condition. It is to be noted that in all cases the stalks were appreciably dried.

295. BILLARDON, F. 664.85.8.037
 Application du froid au traitement des vins et à la conservation des raisins.
 (The use of cold for treating wines and for the preservation of grapes.)
Rev. viticulture, 1934, 80 : 152-7.

This is an extract from an article on the subject presented at the last Lyons fair. The author deals first with the clarification and maturing of wine by cold, next with the use of cold in actual wine making and lastly with the preservation of grapes and unfermented must by cold. The method of grape storage by packing among layers of cork is only applicable to certain varieties, while preservation by hanging with the stalk in water is only suitable for the luxury trade. Trials originating with the Société Méridionale de Transports de Force et de la Distillerie Cooperative de Nissan (Hérault) have now resulted in a plant which will deal with 50 tons of grapes. The method is as follows :—The grapes are picked and brought to the plant in ordinary baskets. They are examined for the removal of damaged grapes or those showing signs of mould or insect damage, and put with curled paper into 7 or 8 kg. receptacles. These are introduced for a few minutes into an autoclave for drying and sterilization, where a slight vacuum is used and antiseptics are injected. Thence they are transferred direct to a chamber having a very high moisture content and kept at 0° C. It was possible using this process to keep late grapes stored at the beginning of October until the end of March economically and without any deterioration in quality. The concentration of must by partial freezing, which enables the separation by centrifuging of some of the water as ice crystals, followed by evaporation in vacuo at a low temperature, is very briefly described. It results in an excellent product without any trace of caramelization.

296. BANNERJEE, B. N., AND OTHERS. 664.85.441
 Investigations on the storage of mangoes.
Agriculture and Livestock in India, 1934, 4 : 36-53, bibl. 9.

The results of the investigations reported here show that cold itself is a means of controlling factors of spoilage, and also indicate that further work might usefully be directed on the utilization of ethylene gas or acetaldehyde vapour or other selective antiseptics against micro-flora during ripening. In cold storage at 0° C. the growth of putrefactive organisms is at a standstill. Mechanical injury has been found to affect the ripening round the injured parts even when symptoms of decay have not otherwise manifested themselves. Sweet varieties of mangoes suffer from the effects of mechanical damage more than sour ones. At 15° C. the rate of ripening is reduced to half that at normal temperature, 25-27° C. At 5° C. all cell activity ceases. Storage in carbon dioxide, 15-20 per cent., has a retarding effect on the process of ripening. Fruit thus stored for 10-12 days ripened in 2-3 days after removal. It had a sweet taste and fragrant odour, the colour, however, being pale yellow instead of the normal red or orange. Mature mangoes ripen in 20-25 days at 5-10° C. At 0° C. fully ripe mangoes can be stored safely for 3-5 weeks. Ripe mangoes and sliced pulp preserved in syrup keep well for 3-4 months. If an antiseptic is added to the syrup the fruit will remain sweet for over a year.

PROCESSING AND FRUIT PRODUCTS.

297. CHARLEY, V. L. S. 663.813

Non-alcoholic apple juice.*Food Manufacture*, 1934, 9 : 91-5, bibl. 7.

It is believed that the utilization of culls of dessert and culinary apples in the manufacture of apple juice for the production of soft drinks will prove profitable to both grower and food manufacturer. The procedure of manufacture consists of the following three main operations. 1. Formation of a coagulum. 2. Removal of deposit. 3. Maturation, carbonation, bottling. 1. Filtration of fresh apple juice being an impossibility, various alternative treatments to produce clarification by physical or chemical means are briefly described. These are:—heat treatment, chemical precipitation, enzymes, low temperature storage, pressure storage, natural fermentation. 2. The deposit can now be removed by filtering or centrifuging, the latter being of especial use where the fermentation process has been adopted. 3. The great difficulty of retaining large quantities of sweet juice in an unfermented condition without elaborate apparatus and procedure is probably best overcome by bottling it immediately after carbonation. Pulp-filtered juice may be carbonated to 30 lb. pressure of CO₂ per sq. inch and pasteurized in bottle for 30 minutes at 150° F. or it may be passed through a germ-proof filter, carbonated in a sterile machine (2 per cent. SO₂ solution is a satisfactory sterilizer for metallic and composition surfaces) and bottled into aseptic containers.

298. POTTER, R. S. 663.813

Fruit pulps and juices. Practical points in the use of preservatives.*Food Manufacture*, 1934, 9 : 126-30, bibl. 3.

The preservatives discussed are sulphur dioxide and benzoic acid, which includes sulphurous acid, sulphites and benzoates. No other preservatives except such substances as salt, vinegar, sugar etc. are permitted by law in England.

299. FOTHERINGHAM, N. S. 634.37-1.564

Experimental orchard, Berri—experiments on the steaming of figs.*Dept. Agr. South Australia bull.* 284, 1933, pp. 3.

The experiment was designed to test the effect of stage of ripeness and treatment on subsequent development of mould in packed figs. Figs in 4 different states were steamed for varying periods, namely 8, 10, 12, 15 and 20 minutes immediately prior to packing. (1) "Green" figs, i.e. figs still of a fresh nature and of a green or yellowish-green appearance, packed into boxes after cooling, (2) "Green" figs packed into boxes when hot, (3) "Partly dried" figs, i.e. figs which on shaking from the tree are naturally well wilted and partly dried, packed hot. (4) "Partly dried" figs packed after cooling. The boxes so packed were examined after 6 months had elapsed. The smell of the figs was good in all cases and no sourness or mould was present. The tests, therefore, as regards the cause of mould were negative, but they did show that the "green" fig sweats more freely than the partly dried. The normal receptacles used are 1 lb. cellophane wrapped and labelled packs, which are in turn packed into a box containing 6 layers of 6 packets each.

300. CONDELLI, F. 665.327.3 : 621.892.09

L'olio d'oliva nella lubrificazione dei motori a combustione interna. (Olive oil for lubricating internal combustion engines.)*L'Agricoltura Coloniale*, 1934, 28 : 125-40.

Competition both at home and abroad has forced olive growing countries to look for other uses for olive oil than the ordinary comestible one. Experiments have taken place on its use as a lubricant. In this article the various characters of the oil are considered together with methods of overcoming by special treatment any unsuitable factors. Experiments in Spain, Tunis, Algiers and France have shown the excellent properties of the oil for lubricating motors—especially the course of the piston in the cylinders, and the writers sum up the advantages over mineral oils as

follows :—(1) Increased power in motor due to less wear of lubricated parts. (2) Lessened carbon deposit. (3) Diminished wear and tear of the cylinder and other parts subject to wear. (4) Less heat development in engine. (5) Easier starting owing to greater fluidity of the oil. Ordinarily deacidified oil from the husks will be found suitable, but for heavier engines special treatment may be necessary to increase viscosity. Greater viscosity may be obtained by previous oxidation or polymerization in different ways.

301. SCHMIDT, A. W., AND GAUPP, K. 665.3 : 621.892.09
Pflanzenöle als Dieselmotortreibstoffe. (**Plant oils for driving diesel engines.**)
Tropenpflanzer, 1934, 37 : 51-9.

Experiments have been in progress for the last 18 months at the Breslau Technical University on the possibility of using plant oils for driving fast running diesel engines i.e. those used in transport work. The results prove the possibility but stress the need for further investigations. In favour of such oils it was found that motors ran more smoothly on them than on the ordinary mineral oils. On the other hand corrosion of copper and brass was noticed where ground nut and palm oils were used and this led to a closer examination of the corrosive action of plant oils on metals. Results varied with different oils, sesamum or soya bean oil being particularly innocuous, and with different metals, aluminium and tin plate being unaffected. Results to date show the necessity for observing the following points when using plant oils for diesel engines :—(1) The motor must be started on mineral oil. (2) The plant oils must be well filtered. (3) The fuel must be warmed previous to combustion. (4) More frequent decarbonization and examination of the combustion chamber is desirable. (5) Further, before stopping the motor it is advisable to run for a short time on mineral oil to clear the passages of plant oil : otherwise difficulty may be experienced in starting.

302. McLEAN, H. C. 632.951.23
The home-made fruit washer.
Trans. Peninsula Hort. Soc., 1933, 23, 5 : 87-90.

The author describes in detail and with illustrations a type of fruit washer which has been successfully used in New Jersey. The dimensions of the apparatus and the actual materials used are specified and instructions are given for the determination of the strength of the acid solution.

NOTES ON BOOKS AND REPORTS.

303. LONG, H. C. 632.954
Suppression of weeds by fertilizers and chemicals.
H. C. Long, Orchard Road, Hook, Surbiton, Surrey, pp. 57, references numerous in text, 2/2 post free.

This small book serves a useful purpose by collecting together in concise form the information available on the value of particular fertilizers and herbicides for the suppression of the normal weeds of this country. As regards fertilizers we find that some have not only indirect action on weeds due to the encouragement of growth in cultivated crops but also a direct destructive action on the weeds themselves. Thus calcium cyanamide, sulphate of ammonia and finely powdered kainit all possess this character when suitably used. The author discusses in turn the herbicidal effects of the following :—lime, sulphate of ammonia and nitrate of soda, calcium cyanamide, sulphuric acid (used in France since the end of last century and now beginning to gain popularity here.—ED.), copper and iron sulphates, finely powdered kainit (used especially in cases where potash manuring is also necessary), sodium and potassium chlorates, arsenical compounds, and miscellaneous chemicals such as salt, lawn sands, nitric, carbolic and hydrochloric acids, nickel sulphate, copper nitrate, carbon bisulphide, ammonium thiocyanate, potassium chloride, washing and caustic sodas, bisulphate of sodium, oils such as kerosene. In most cases details of suitable rates of application are given and any special precautions are noted. References are given in the text for the benefit of those wanting more detailed information. An interesting list of common weeds with their scientific names concludes the book.

304. PETRI, L. 634.3-2.1/8
Le alterazioni dei frutti degli agrumi. (Disease phenomena in citrus fruits of parasitic and physiological origin.)
 Arti grafiche Pizzi e Pizio, Corso Roma 121, Milan, Italy, 1933, pp. 44,
 coloured plates 53, 30 liras.

The description of the ailments contains where possible the names used commonly in California or Florida. Though slight notes are indeed given as to cause and possible remedy, the book should be especially useful for identifying specimens of fruit which have deteriorated for some reason or other undetermined. The plates contain on the average two beautifully clear reproductions in colour; 32 plates illustrate the phenomena due to physiological causes, 7 those whose cause is undetermined and 24 those caused by bacteria, fungi or insect pests.

305. IRVINE, F. R. 633/4+631.4
A text book of West African agriculture. Soils and Crops.
 Oxford University Press, London, 1934, pp. 339, bibl. 41, 7/6.

The opening chapters give general instruction on the principles of agriculture. Subsequent chapters deal individually with the chief crops of West Africa as cultivated under local conditions, and these contain much of interest particularly in connection with native methods of culture.

306. HARLER, C. R. 633.72 : 334.6
The culture and marketing of tea.
 Oxford University Press, London, 1933, pp. 389, references numerous, 12/6.

The author of this book has recently retired from 14 years of scientific investigation at the Indian Tea Association's Experimental Station at Tocklai, Assam, during which time a close connection was also maintained with the commercial tea gardens of Assam and Bengal. He can therefore claim to speak with authority on this subject. The book is divided into four parts:—(1) a general account of the tea plant, its cultivation and manufacture, (2) the chemistry and pharmacology of tea, (3) the methods employed in the chief tea countries of the world, special attention being paid to North-East India, (4) the British tea trade. Every aspect of tea growing and manufacture is discussed in considerable detail and the many passages relating to scientific investigation are well documented. The book must obviously prove of value to all engaged in the industry whether commercially or scientifically.

307. WINDLE, E. G. 633.73
Modern coffee planting in India.
 John Bale, Sons, and Danielsson, Ltd., London, 1933, pp. 232, 10/6.

In the preface the author states that his idea in writing this book was to provide a ready reference book whose presence might do something to insure against the mistakes of omission and commission which are so liable to occur on even the best run plantations. He emphasizes that the book is not written with the idea of inducing any young man to take up coffee planting as a career, since the industry, if it expands, can do so but slowly, and in any case, owing to the slump in rubber and tea, there are hundreds of planters available whose experience, even though it may not have been of coffee, would still obviously obtain them the preference when vacancies occur. The racy manner in which the book is written makes it easy to read while it does not cloak the valuable practical instruction which is to be found on every page. The many references to the experiences of the very early days of coffee growing when pests and diseases first became obtrusive and scientific experimentation was unknown are of interest. The author acknowledges his debt to the writings of scientists for much of his more technical information and the scientists might well congratulate the author on the palatable dish he has prepared from the dry bones which they, perforce, so often have to provide.

308. NEW ZEALAND. 634.1/7(931) (058)
7th Ann. Rept. Dept. Scientific and Industrial Research,
Wellington, for 1932-3, 1933, pp. 82.

In this report the agricultural research in New Zealand for the period is summarized. In respect of fruit production investigations on the following are in progress or completed. Spraying experiments with specifics containing sulphur, lime-sulphur and copper, as a result of which many orchard spraying practices have been profoundly modified. Fruit tree canker. Fungous diseases of fruit in cold store. The presence of a serious virus disease in strawberries has been revealed, and endeavours are being made to raise virus-free strains. Diseases of tomatoes. In manurial trials at the Research Orchard the best results from nitrogen were obtained from the distribution of the nitrogen in a circle with a radius of not more than 6 feet from the trunk. On poor land at Waimea West 3 lb. of sulphate of ammonia per tree compared with 1 lb. per tree increased the yield by 70 lb. per tree. So far the effects upon growth and yield of phosphate and potash applications are obscure. The application of lime to lemon trees in the Auckland district produced yield increases of up to 35 lb. per tree. The root system of Northern Spy is being compared with other apple varieties and the effects of the relative amounts of fibrous and large roots upon differences in yield is being studied. Trials to demonstrate the influence on fruit quality of locality and type of soil, drainage, wrapping, packing, maturity, high and low transport temperatures and pre-cooling have been carried out with the most important export varieties of New Zealand apples. The considerable loss due to bruising is to be investigated during the present season.

309. WESTERN NUT GROWERS' ASSOCIATION. 634.5
Proc. 19th Annual Meeting, McInnville, Oregon, 1933, pp. 100-157.

This report which is bound up with the annual report of the Oregon State Horticultural Society contains articles dealing with the following subjects :—The desirability of planting walnut trees and the number of trees to the acre—The use of tractors and horses on the walnut farm—The manuring of walnuts—The bleaching of red walnuts—The pruning of filberts and of walnuts—Walnut blight.

310. PENNSYLVANIA STATE HORTICULTURAL ASSOCIATION. 634.1/7
Proceedings of 75th Annual Meeting, 1934, being Penn Sta. Hort.
Assoc. News, vol. 11, No. 1, pp. 101.

Among papers given at this meeting the following may be noted. *Some recent trends in American orcharding.* Among recent trends Gourley notes from Ohio :—the use of milder and less caustic sprays in conjunction with more thorough application—the elimination of some of the causes of russetting such as spraying at the wrong time or pressure or with too coarse material—the introduction of irrigation—the study of soil conditions round the roots and the possibility of introducing fertilizers into the soil round the roots—lighter pruning in the earlier years followed by sufficient pruning to maintain a fairly open tree—a study of the effect of nutritional conditions on the set of fruit. *Making the most of rainfall in the orchard.* Anthony suggests that the great waste of valuable fertilizer materials due to erosion can be largely eliminated by cutting down run-off facilities, and by introducing permanent sod or sod rotation, the latter being preferable. In *Results of codling moth experiments in 1933* Worthley discusses the tremendous undertaking of spraying, scraping, pruning, banding, thinning and washing necessary to control codling moth and details the various treatments suggested. Hodgkiss also deals with control of this pest in *Codling moth and rosy aphid suppression*, recommending lead arsenate spray with casein as a spreader together with nicotine sulphate under certain circumstances. He also considers the respective merits of nicotine-lime sulphur, cresylic acid-oil and tar oil-petroleum oil for use against the rosy aphid. Hartzell in *Tar distillate emulsions for the control of the rosy aphid* also discusses the best treatment for rosy aphid, comparing tar distillates, cresylic acid and nicotine sprays, and makes a suggestion that growers should test the effectiveness of the different treatments mentioned.

311. BALLY, W. 633.73
Le café en 1931 et 1932: Questions économiques et techniques. (Coffee in 1931 and 1932.)
 International Institute of Agriculture, Rome, 1933, pp. 232, bibl. numerous, 20 liras.

This volume constitutes a review of the whole subject of coffee growing throughout the world for the years 1931 and 1932, reinforced by very complete bibliographies. Special attention is paid to the economic situation, recent literature, pests and diseases. In these sections each coffee growing country is treated separately. There are more general chapters on the statistics of production and consumption, prices and methods of preparation. Matters of cultivation are dealt with in the chapter on recent scientific literature. A useful paragraph is one in which English technical terms in connection with coffee pruning are translated into French, Spanish and Dutch. Illustrations of the same subject lifted (with permission) from Macdonald's *Coffee Growing*, have not fully recovered from the shock of transplantation but are, nevertheless, clear enough.

312. DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. 664.84 + 664.85
Report of the Food Investigation Board for 1932, 1933, H.M. Stationery Office, London, pp. 304, 5/-.

The articles contained in this report are mainly very short, highly technical and often in the nature of a preliminary or progress report. It has therefore been thought best, with a few exceptions, merely to list them. *Part I. Low Temperature Research Station. Section F*, pp. 51-96. (1) *Articles dealing with fruit storage* (see also Part III):—Effects of ethylene and of apple vapours on the ripening of fruits, pp. 55-8.—The control of superficial scald of apples,* pp. 58-62.—The action of certain volatile substances and gases on the growth of mould fungi, pp. 62-5.—The prevention of mould on stored fruit by the use of gases and volatile substances, pp. 65-6.—Experimental study of moulds responsible for the wastage of apples, pp. 66-8.—Respiration, heat production and gas storage of bananas, pp. 68-70.—Biochemical study of senescence in apples†, pp. 70-75.—Changes in the nitrogen of Bramley's Seedling apples during cold storage, pp. 75-9.—The importance of small differences in temperature in the cold storage of apples, pp. 83-4.—Tolerance of frost and of abnormal atmospheres in New Zealand apples, pp. 84-6.—Wastage in New Zealand fruit, pp. 86-8.—The effect of freezing upon vitamin C of apples, p. 89.—The effect of stock upon vitamin C of apples [None found as yet—Ed.]—Frozen fruit and vegetables, pp. 92-4.—Concentration of orange juice, pp. 95-6. (2) *Articles dealing with vegetable storage* (see also Part III):—Effects of ethylene and of apple vapours on the sprouting of potatoes, pp. 51-3.—Effects of ethylene on the respiration and sugar content of potatoes, pp. 53-4.—The relation of the respiration of potatoes to the concentration of sugars and to the accumulation of a depressant at low temperatures, pp. 80-82.—Low temperature tolerance of summer and autumn grown hot house tomatoes, pp. 82-3.—Preliminary trials of the storage of new potatoes, pp. 91-2.—Frozen fruit and vegetables, pp. 92-4. *Section E. Canning*, pp. 163-80. The following short articles or notes are contained:—The effect of traces of other metals on the rate of corrosion of tin by citric acid.—The effect on the corrosion of iron of ferrous iron in solutions of citric acid of different hydrogen-ion concentration in the presence of a limited supply of air.—The effect on corrosion of protecting certain regions of mild steel test pieces with lacquer.—The acid corrosion of strips of mild steel from which the film of oxide has not been removed.—The corrosion of steel and tin plate by acids other than citric.—The effect of metals used in plant on the colour of raspberries, strawberries and black currants.—Practical canning, the cooling of cans.—The effect of sugar containing an inhibitor of the corrosion of steel on the rate of formation of hydrogen swells and perforations. *Part III. Ditton Laboratory. Section A*, pp. 207-64. *Fruit and vegetables*. Gas storage of apples‡, pp. 207-8.—Gas storage of tomatoes§, pp. 209-11. *Section B. Biological engineering*.

* See 290.

† See 289.

‡ See 288.

§ See 293.

The experimental hold, pp. 212-48.—The uninsulated store, pp. 248-52.—Leakage of heat into ships' insulated spaces, pp. 252-3.—Atmospheric control in ships' holds, pp. 254-6.—The leakage of carbon dioxide from gas stores, pp. 256-3.—Permeability of apple wrappers, pp. 263-4. *Part IV.* pp. 273-300. Researches on the chemistry and biology of fruit by the Imperial College of Science and Technology.

[*Part II.* Work of Torrey Research Station. Does not concern this Bureau.]

313. EAST MALLING RESEARCH STATION.

634.1/7(058)

Annual Report for 1933,* A17, 1934, pp. 268.

The report consists of four sections. The first, pp. 13-26, deals with the experimental farm with notes on the crops produced and prices received and contains the routine spray calendar adopted during 1933. The second section, pp. 27-57, is a general review of research work in progress and consists of short notes contributed by those responsible for carrying on the various research items. Section three, pp. 59-242, contains 28 short progress reports on the different trials. The fourth section, pp. 243-264, is devoted to bulletins specially written for the practical grower. The section concludes with a list of further publications issued by members of the staff in 1933, and a list of available publications brings the report to an end.

* Many of the articles in sections 3 and 4 are abstracted or noted in the present or next number of *Horticultural Abstracts*.